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# NAVAL POSTGRADUATE SCHOOL

## Monterey, California



# THESIS

An Accuracy Analysis of  
The Army Materiel System Analysis Activity  
Reliability Growth Model

by

Donald Paul Amiotte

June 1980

Thesis Advisor:

W. M. Woods

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An Accuracy Analysis of  
The Army Materiel System Analysis Activity  
Reliability Growth Model

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Submitted in partial fulfillment of the  
requirements for the degree of

MASTER OF SCIENCE IN OPERATIONS RESEARCH

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NAVAL POSTGRADUATE SCHOOL  
June 1980



## ABSTRACT

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In this paper, a statistical model known as the AMSAA reliability growth model, is evaluated by measuring how well it tracks various reliability growth patterns. These patterns are defined by specified sequences of failure rates. Monte Carlo simulation is used to generate test data based on a time-terminated test plan. Estimates of failure rates, computed using the AMSAA model, are compared with the specified failure rates. Results for 18 reliability growth patterns are presented in both tabular and graphical form. Four modifications in the use of the model are discussed with selected results of their application presented.





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## I. INTRODUCTION

Many methods of modeling reliability growth have been proposed and used with some success. Reference 1 contains a detailed discussion of reliability growth, reliability growth models, and describes several models that are available to the manager for use in measuring reliability growth in his program.

The purpose of this study is to evaluate the accuracy of the Army Materiel Systems Analysis Activity (AMSAA) reliability growth model [Ref. 1] for systems which provide limited test data during the development cycle.





## II. THE AMSAA RELIABILITY GROWTH MODEL

The AMSAA reliability growth model is a statistical model that estimates reliability growth trends. It is applicable to systems for which usage data is measured on a continuous scale.

As with most reliability growth models, the AMSAA model uses test data to estimate unknown parameters which are then used to estimate the reliability growth trend. References 1 and 2 develop the AMSAA model in detail. This paper addresses the use of the AMSAA model for sequential, time-terminated testing.

Time-terminated testing occurs when each item is tested until failure or until that item has been tested a specified amount of time. If an item does not fail before the planned test time, then a failure has not occurred and the next item is tested.

For time-terminated testing, the AMSAA model [Ref. 1] provides the following estimate for the failure rate of a type of hardware unit (component, assembly, subsystem, system) at total accumulated test time T on that type of unit;

$$\hat{r} = \hat{\beta} \left( \frac{N}{T} \right) ,$$

where N = number of failures of that type of item to  
time T



and

$$\hat{\beta} = \frac{N}{N \ln T - \sum_{j=1}^N \ln X_j}$$

with  $X_j$  = total accumulated test time over all items tested when the  $j$  th failure occurs.

Using these estimators, the accuracy of the AMSAA model was evaluated for a variety of reliability growth patterns.



### III. TESTING PROCEDURE

Reliability growth models are often evaluated against actual test data. The problem with evaluating a model against actual data is that the failure rate driving the system at any one time is never known, it can only be estimated.

The purpose of this chapter is to describe the test plan under which the analysis was made and define the test organization used. Figure 1 shows the relationship between the elements of the test plan and the organization of the testing.

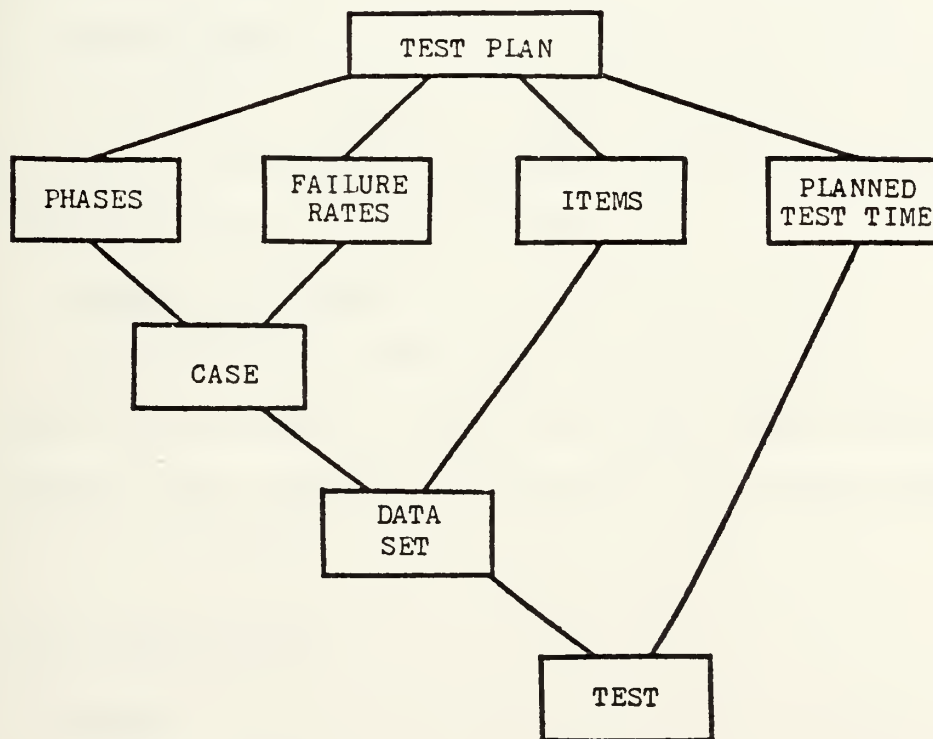


Figure 1. Test Organization



## A. TEST PLAN

The key elements of the test plan used for the evaluation of the AMSAA model are described below.

### 1. Phases

Tests were conducted in phases consisting of testing a specified number of items with randomly generated exponential failure times based on the failure rate specified for that phase.

### 2. Failure Rates

Each phase had a specified failure rate, which was assumed to be constant for the duration of the phase. The failure rates specified could be different from phase to phase. This set of failure rates defined the reliability growth pattern for a test.

### 3. Items Tested

A specified number of items was tested in each phase. In this analysis, the number of items tested was the same for each phase in any one test.

### 4. Planned Test Time

Each item in a phase was tested to failure or until the specified planned test time for that phase was reached. The planned test time was the same for all items tested during any one phase.

## B. TEST ORGANIZATION

### 1. Cases

The AMSAA model was applied to 18 test cases where each case was defined by a set of failure rates and a





specified number of phases. The general shape of the various cases, classified by number of phases and by trend of growth, can be found in Figures 2 through 5. Test phases are plotted, equally spaced, on the horizontal axis and failure rates are plotted on the vertical axis.

a. Set of Failure Rates

Each set of failure rates defined a reliability growth curve which was then classified by its general trend of growth into one of two categories:

- (1) Non-increasing Failure Rates  
(Figures 2 and 3)
- (2) Failure Rates that Increase  
at least once during testing  
(Figures 4 and 5)

b. Number of Phases

In addition to their growth trend, cases were grouped, for comparison, by their total number of phases. The two groups are those that have 16 phases and those that have 6 phases.

(1) 16-Phase Cases. Cases 1 through 6 (Figure 2) and cases 13 through 18 (Figure 5) were each defined by specifying 16 failure rates, one for each of the 16 test phases.

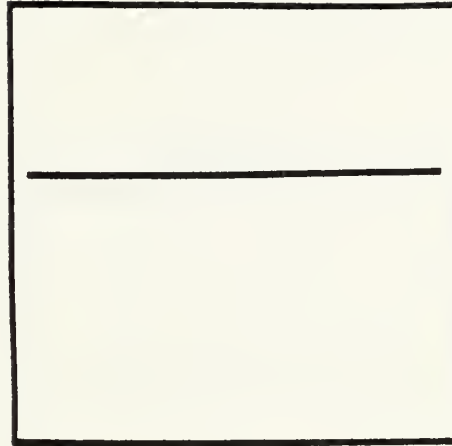
(2) 6-Phase Cases. The growth patterns for cases 7 through 12 (Figures 3 and 4) were defined by a set of six failure rates. Some of the cases reflect the same growth patterns shown for the 16-Phase cases, except that, the testing was carried out for only six test phases.



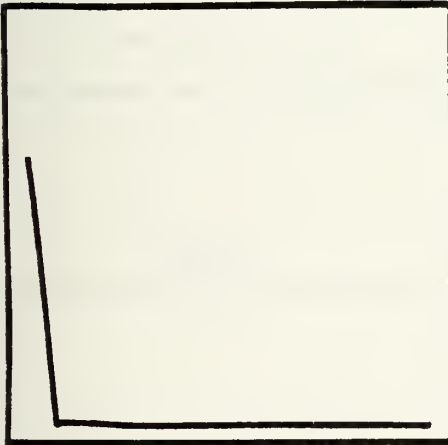
CASE 1



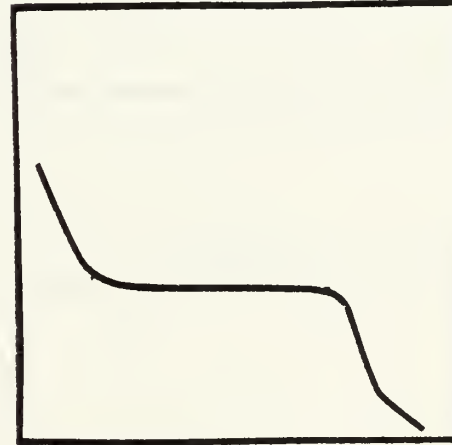
CASE 2



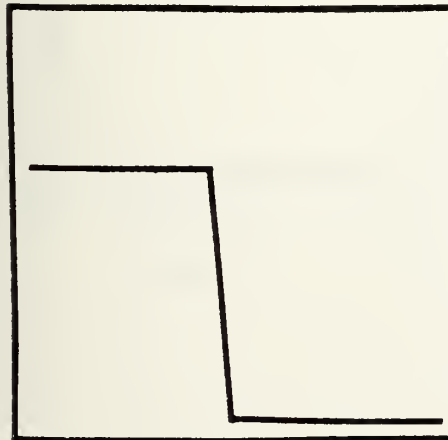
CASE 3



CASE 4



CASE 5



CASE 6

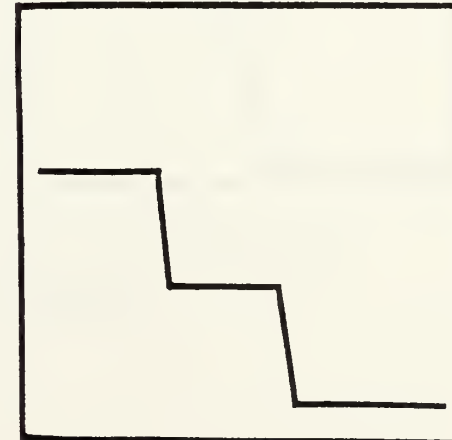
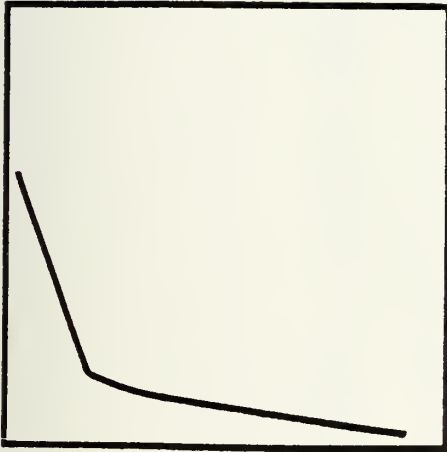


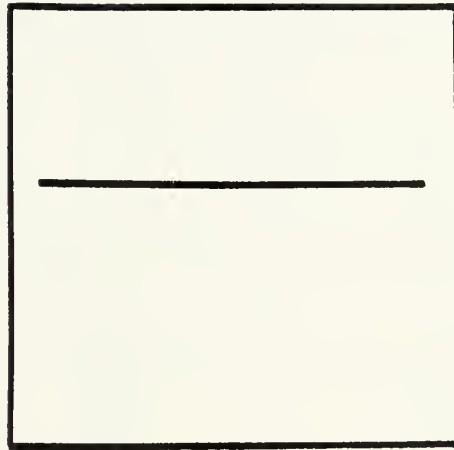
Figure 2. 16-Phase Cases with Non-increasing Failure Rates



CASE 7



CASE 8



CASE 9



CASE 10

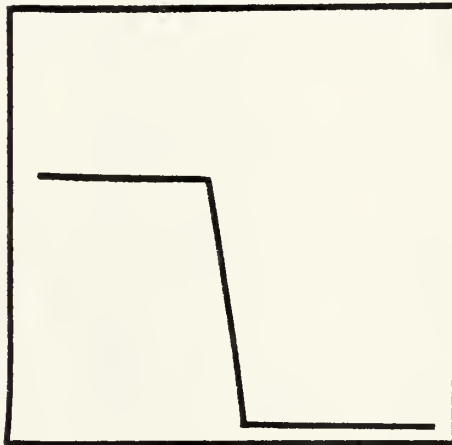


Figure 3. 6-Phase Cases with Non-increasing Failure Rates



CASE 11



CASE 12

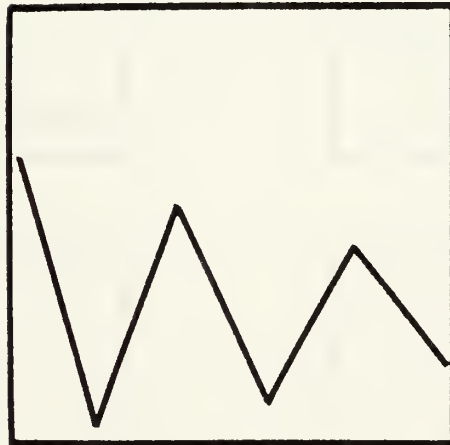


Figure 4. 6-Phase Cases with Failure Rates that Increase

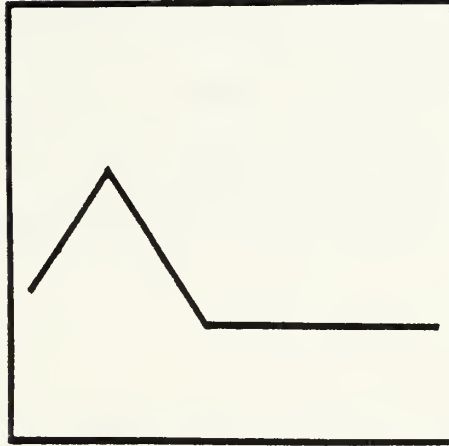




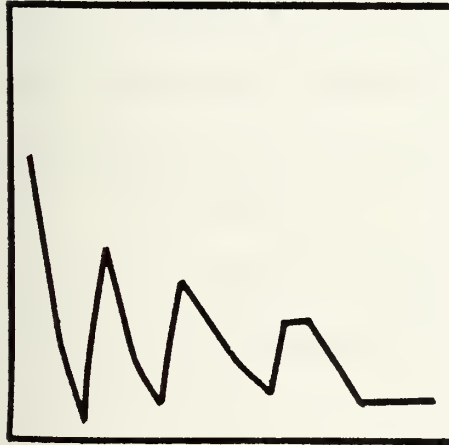
CASE 13



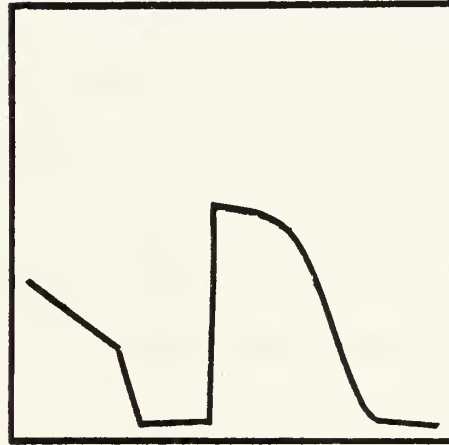
CASE 14



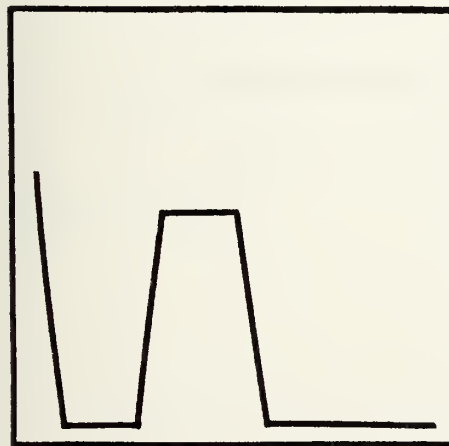
CASE 15



CASE 16



CASE 17



CASE 18

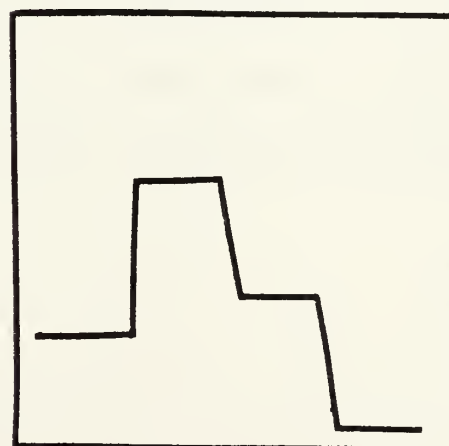


Figure 5. 16-Phase Cases with Failure Rates that Increase



## 2. Data Sets

Specification of the number of items to be tested in any phase for a particular case resulted in a Data Set. The number of items tested during a phase was the same for each phase of testing. Three sets of test data were generated for each case, one set each for tests with 5, 10, and 20 items per phase.

## 3. Tests

The remaining element of the test plan, Planned Test Time, was used to define individual tests. Since the failure rate underlying the exponential test times was known, planned test times were chosen so that the probability of survival was such that sufficient failures would occur.

### a. Test 1

The planned test times for Test 1 were generated so that the probability of survival for each item would be .85.

### b. Test 2

Test 2 consisted of generating planned test times by using a probability of survival for each item of .99. This test was run to see how the model performed with very limited data.



## IV. ANALYSIS PROCEDURE

### A. MODEL ESTIMATES

#### 1. Shape Parameter

Using the test data generated above, the shape parameter for the model was estimated at the end of each phase,  $i$ , using the AMSAA estimator:

$$\hat{\beta}_i = \frac{N_i}{N_i \ln T_i - \sum_{j=i}^{N_i} \ln X_j},$$

where

$N_i$  = number of failures that occurred to the end of phase  $i$ ,

$T_i$  = total accumulated test time over all items to the end of phase  $i$ ,

and  $X_j$  = total accumulated test time over all items when the  $j$  th failure occurs

with a small exception.<sup>1</sup>

#### 2. Failure Rate

The model estimate of the failure rate at the end of the  $i$  th phase was computed in accordance with the AMSAA model as follows:

---

<sup>1</sup> It should be noted that the estimate of  $\beta$  can only be computed when  $N_i > 1$ . If  $N_i = 1$ , the failure must not occur as the last item of a phase since, in that case,  $T_i = X_i$ , thus making  $\hat{\beta}$  an indeterminate form.



$$\hat{r}_i = \hat{\beta}_i \left( \frac{N_i}{T_i} \right) .$$

This resulted in a set of failure rate estimates that was then compared to the set of specified failure rates used to generate the test data.

## B. EVALUATION CRITERIA

The manager using a reliability growth model is interested in two things, accuracy and variability.

### 1. Accuracy

Accuracy measures the ability of the model to track a reliability growth trend. The measure of accuracy used in evaluating the AMSAA model was the failure rate estimate error as a percentage of the actual failure rate.

This percentage error is defined as follows:

$$e_i = \frac{|\bar{r}_i - r_i|}{r_i} \times 100 ,$$

where  $\bar{r}_i$  = mean estimate of the failure rate for the  $i$  th phase<sup>2</sup>

and  $r_i$  = specified failure rate for the  $i$  th phase.

This measure of error was calculated at the end of each phase and used to trace the accuracy of the model over

---

<sup>2</sup> Sample may be less than the 100 replications simulated. See footnote 1, page 17.





all phases of each test case. This estimate error, as a percentage of the actual failure rate, can be found in the tabulated statistics for each Data Set of the tests contained in the appendices.

## 2. Variability

A manager, considering a reliability growth model for use in a program, will not only be concerned with the model's accuracy, but will be concerned with the variability of the estimates the model provides.

The simulation used for this evaluation was replicated 100 times. The mean estimates used to evaluate the tracking and measure the accuracy of the model only have value over the long run. A manager, however, is primarily interested in the one real application of the model. He is concerned with how well a model performs for a single replication and is thus ultimately concerned about the variability of the estimates he gets from the model in addition to its tracking accuracy.

The measure of variability used for this study was the standard deviation about the mean estimate of the failure rate,  $\bar{r}_i$ ,

$$\text{S.D.}(\hat{r}_i) = \sqrt{\frac{1}{K} \sum (\hat{r}_i - \bar{r}_i)^2},$$

where K = number of replications that yielded estimates.



As with the failure rate percent error, the standard deviation of the failure rate estimate is contained in the tabulated statistics for each data set.



## V. RESULTS

### A. GENERAL DESCRIPTION

The results of the analysis are presented in the following manner. The output for each test is contained in a separate appendix to this paper. A data set is identified at the top of each page. This heading consists of the case number and the number of items for the data set. The output for each data set consists of two parts; the tabulated statistics and a performance plot. Figure 6 is a sample of the presentation of the results of a typical data set.

#### 1. Tabulated Statistics

The input parameters, model estimates, measures of performance, and system status at the end of each phase of testing are tabulated for each data set. The values given are the average values over all replications for the data set. Figure 6 shows the format of the tabulated results. The following paragraphs describe each line of the format.

##### a. Input Parameters

(1) PHASE. This line indicates the phase of testing for the results listed below. Throughout the appendices, results for 6- and 16-phase growth patterns are presented. For 16-phase cases, the first 8 phases are tabulated above a row of asterisks. The same format is then repeated below the asterisks for phases 9 through 16.



CASE 1

10 ITEMS

| PHASE   | 1       | 2      | 3      | 4      | 5      | 6      | 7       | 8       |
|---|---------|--------|--------|--------|--------|--------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.7020  | 0.4340 | 0.3200 | 0.2550 | 0.2130 | 0.1830 | 0.1610  | 0.1440  |
| PLANNED TEST TIME                                   | 0.2215  | 0.3745 | 0.5079 | 0.6373 | 0.7630 | 0.8861 | 1.0054  | 1.1266  |
| MODEL ESTIMATE                                      | 5.4898  | 0.6276 | 0.4602 | 0.3268 | 0.2581 | 0.2308 | 0.1957  | 0.1691  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 682.03  | 46.51  | 40.70  | 28.16  | 21.16  | 26.14  | 21.53   | 16.75   |
| SAMPLE STD DEVIATION                                | 23.0502 | 0.4566 | 0.3009 | 0.1996 | 0.1228 | 0.1143 | 0.0903  | 0.0685  |
| CUMULATIVE TEST TIME                                | 2.148   | 5.623  | 10.305 | 16.239 | 23.271 | 31.330 | 40.675  | 51.174  |
| CUMULATIVE FAILURES                                 | 1.3300  | 2.8500 | 4.5300 | 5.9300 | 7.4700 | 9.1500 | 10.6200 | 12.7100 |

| PHASE   | 9       | 10      | 11      | 12      | 13      | 14      | 15      | 16      |
|---|---------|---------|---------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.1350  | 0.1160  | 0.1090  | 0.1010  | 0.0936  | 0.0876  | 0.0823  | 0.0776  |
| PLANNED TEST TIME                                   | 1.2219  | 1.3773  | 1.4910  | 1.6091  | 1.7363  | 1.8552  | 1.9747  | 2.0943  |
| MODEL ESTIMATE                                      | 0.1523  | 0.1285  | 0.1246  | 0.1127  | 0.1055  | 0.0977  | 0.0912  | 0.0854  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 14.48   | 17.24   | 14.29   | 11.61   | 12.76   | 11.58   | 10.85   | 10.54   |
| SAMPLE STD DEVIATION                                | 0.0534  | 0.0447  | 0.0367  | 0.0332  | 0.0258  | 0.0265  | 0.0219  | 0.0207  |
| CUMULATIVE TEST TIME                                | 62.421  | 75.054  | 88.887  | 103.821 | 119.802 | 136.857 | 154.152 | 174.540 |
| CUMULATIVE FAILURES                                 | 13.5200 | 15.0600 | 16.4500 | 17.7900 | 19.3500 | 20.6200 | 22.3200 | 23.8000 |

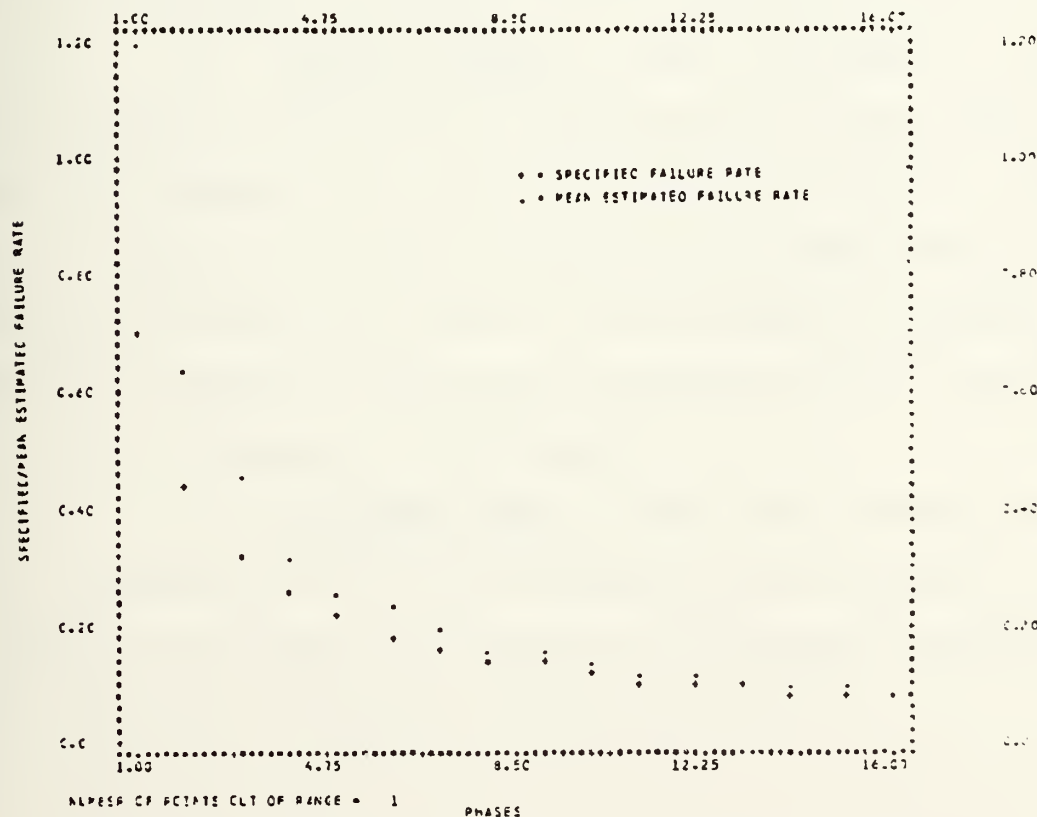


Figure 6. Format for Results of a Data Set





(2) ACTUAL FAILURE RATE. This row consists of the sequence of specified failure rates that defines the reliability growth curve for the test case given in the heading. In Figure 6, the specified failure rates for Phases 8 and 9 are 0.1440 and 0.1330 respectively.

(3) PLANNED TEST TIME. Here, the time to which each item was tested if it did not fail, is given. This number was based on the actual failure rate and the specified probability of survival for the test. This test time was the same for all items tested in a phase. For example, 10 items were tested in each of the 16 phases shown in Figure 6. Those items tested in Phase 8 were tested for 1.1286 time units or until failure.

b. Model Estimates

(1) MODEL ESTIMATE. Line 4 of Figure 6 contains the estimates of the failure rate provided by the AMSAA model (see Section IV-A) for each phase of testing. Referring to Figure 6, it can be seen that the model estimate of the failure rate at the end of the 8th Phase of testing was 0.1681 as compared to the actual failure rate of 0.1440.

c. Measures of Performance

(1) ESTIMATE ERROR. Here, the estimate error as a percentage of the actual failure rate, is given. Again, looking at the results for Phase 8, the percent error of 16.75 is found. This was computed as follows:



$$\frac{0.1681 - 0.1440}{0.1440} \times 100 = 16.74$$

The difference in the two percent errors is due to the extra accuracy carried by the computer.

(2) SAMPLE STD DEVIATION. The next line of entries is the standard deviation of the model estimate. This criteria is discussed in Section IV-B. The standard deviation of the model estimate for Phase 8 is 0.0685.

#### d. System Status

(1) CUMULATIVE TEST TIME. This row contains the total test time over all items as of the end of the indicated phase. At the end of the 8th Phase of testing, 51.176 time units of testing had been performed on the system.

(2) CUMULATIVE FAILURES. The final entry in the table is that of total failures on the system to the end of the phase. As illustrated by Figure 6, an average of 12.01 failures occurred over all replications. This means that, of the 80 items tested to the end of the 8th Phase, 12 failed.

## 2. Performance Plot

As an aid to evaluating the tracking accuracy of the model, the specified failure rate and the estimated failure rate are plotted for each phase of a test. Figure 6 contains an example of a typical plot.



All failure rates are plotted on a scale of 0 to 1.2. If an estimate is greater than 1.2, it is plotted at 1.2 and is noted as a point "out of range". More precise values of the points plotted can be obtained from the tabulated output above the plot.

The phases, for each failure rate plotted, are scaled on the horizontal axis. By referring to the CUMULATIVE TEST TIME row of the tabulated statistics above the plot, the amount of test time on the system, to the end of a phase, can be found.

For example, in Figure 6, the items tested had 51.176 time units of testing at the end of Phase 8 and 62.421 time units at the end of Phase 9. Thus test Phase 9 consisted of 11.245 time units of testing.

## B. TEST 1

The results for Test 1 are given in Appendix A. Model estimates, made when cumulative test times on the system were less than 10 hours, had a high percentage error and large standard deviations. Testing more items per phase tended to provide better estimates earlier in the testing.

### 1. Non-increasing Failure Rates

As would be expected, the AMSAA model tracks growth patterns that approximate continuously decreasing curves (Case 1) better than those that have drastic step changes (Case 6). The model had a tendency to provide estimates which lag behind the actual value of the failure rate.



This is reflected in the increase in percentage error during the latter phases of testing. As can be seen in Case 4, several phases of constant failure rate will cause the model to lag behind even moderate changes in the failure rate.

## 2. Failure Rates that Increase

As can be seen in the performance plots of Cases 11 through 18, the AMSAA model has a tendency to smooth oscillations in the failure rate. This also seems to be due to the tendency of the model to provide estimates of the failure rate that lag the actual failure rate when the growth pattern makes large step changes. This characteristic can cause some large percentage errors and standard deviations in the later phases of testing when the failure rate increases for any reason.

### C. TEST 2

Test 2 used planned test times generated for a probability of survival of .99. This resulted in far fewer failures during the testing which severely curtailed the model's ability to track a reliability growth pattern.

Appendix B contains the results for some representative cases. As in Test 1, a minimum number of test hours or failures is required for the model to make an accurate estimate. This requirement is not met when a high reliability system is being tested.





The results in Appendix B show a high percent error and a large standard deviation for the estimates made during the test.

#### D. MODIFICATIONS

As discussed above, the percentage error and the sample standard deviation of the model estimates were high during the early phases of testing and when failure rates increased. In an attempt to reduce this error, the AMSAA model was used in four modified test situations. All four tests used the point estimate of the failure rate

$$r_p = \frac{\text{number of failures during a phase}}{\text{total test time during a phase}} .$$

It should be noted that the number of failures and the test time used to compute the point estimate are not accumulated over all phases but are only for the current phase of testing.

The point estimate,  $r_p$ , was used for any phase where the cumulative test time on the system was less than 10 hours. Once the 10 hour threshold was exceeded, AMSAA model estimates were used. These estimates were made using all data from the beginning of testing if the failure rate was not considered to have increased. The four modified tests differed only in their handling of increasing failure rates.



## 1. Estimating Slope

In order to determine whether the trend of failure rates was increasing, the slope of the trend was estimated. Two methods were used:

### a. 2-Point Estimate of Slope

The slope was estimated using the point estimate,  $r_p$ , for the current phase and the last estimate,  $\hat{r}_{i-1}$ , which may have been from the model or a point estimate.

$$\text{Thus } \text{SLOPE} = r_p - \hat{r}_{i-1} .$$

### b. 3-Point Estimate of Slope

This method of estimating slope was used to reduce the change that the estimated slope would be affected by a randomly high point estimate. The slope was estimated using the point estimate,  $r_p$ , for the current phase and the last two estimates  $\hat{r}_{i-1}$  and  $\hat{r}_{i-2}$ . The slope estimated consisted of two parts:

$$\hat{r}_{i-1} - \hat{r}_{i-2} \quad \text{and} \quad r_p - \hat{r}_{i-1} .$$

For the estimate of the slope to be considered increasing, both parts had to be determined to be increasing.

## 2. Determining Increasing Slope

Two methods of determining when an estimate of slope could be considered increasing were used. The estimates of slope described above were tested in one of the



following ways for each of the modified tests.

$$\text{SLOPE} \geq .07$$

$$\text{SLOPE} \geq .2\hat{r}_{i-1}$$

### 3. Modified Tests

Figure 7 shows the composition of each of the four modified tests.

|                              | SLOPE $\geq$ .07   | SLOPE $\geq$ .2 $r_{i-1}$  |
|------------------------------|--|--|
| 2-Point<br>Slope<br>Estimate | <u>MOD1</u><br><br>$r_p - r_{i-1} \geq .07$  | <u>MOD2</u><br><br>$r_p - r_{i-1} \geq .2r_{i-1}$  |
| 3-Point<br>Slope<br>Estimate | <u>MOD3</u><br><br>$r_{i-1} - r_{i-2} \geq .07$<br>and<br>$r_p - r_{i-1} \geq .07$ | <u>MOD4</u><br><br>$r_{i-1} - r_{i-2} \geq .2r_{i-2}$<br>and<br>$r_p - r_{i-1} \geq .2r_{i-1}$ |

Figure 7. Composition of the Modified Tests



The results of the modified tests are presented in the appendices as follows:

| <u>TEST</u> | <u>APPENDIX</u> |
|-------------|-----------------|
| MOD1        | C               |
| MOD2        | D               |
| MOD3        | E               |
| MOD4        | F               |

Cases 4, 13, 15, and 18 are presented for each test.





## APPENDIX A

### Results of Test 1

The results of Test 1 for Cases 1 through 18 are contained in this appendix. Each case consists of three data sets, one each for 5, 10, and 20 items. The results are presented in two parts; the tabulated statistics and a performance plot. The elements of the tabulated statistics are described below. For 16-phase cases, the first eight phases are presented above the asterisks and the last eight are shown below.

#### 1. Input Parameters

##### a. PHASE

This line indicates the phase of testing for which the elements listed below apply. All statistics are as of the end of the indicated phase.

##### b. ACTUAL FAILURE RATE

This line contains the failure rate specified for the indicated phase. This failure rate was used to generate the exponential failure times used as data for the model.

##### c. PLANNED TEST TIME

This is the test time to which each item was tested if failure did not occur earlier. For Test 1, the planned test times were generated so that the probability of survival was ,85.



2. Model Estimates

a. MODEL ESTIMATE

This is the estimate of the failure rate provided by the model for the test phase indicated (See Section IV-A).

3. Measures of Performance

a. ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE

These entries were computed as a measure of accuracy to be used for evaluating the tracking accuracy of the AMSAA model (See Section VI-B).

b. SAMPLE STD DEVIATION

These values were computed as a measure of variability for the estimate error (See Section IV-B).

4. System Status

a. CUMULATIVE TEST TIME

The times listed are the total test time accumulated over all phases of testing to the end of the indicated phase.

b. CUMULATIVE FAILURES

These entries are the total failures over all items tested for all phases through the indicated phase.

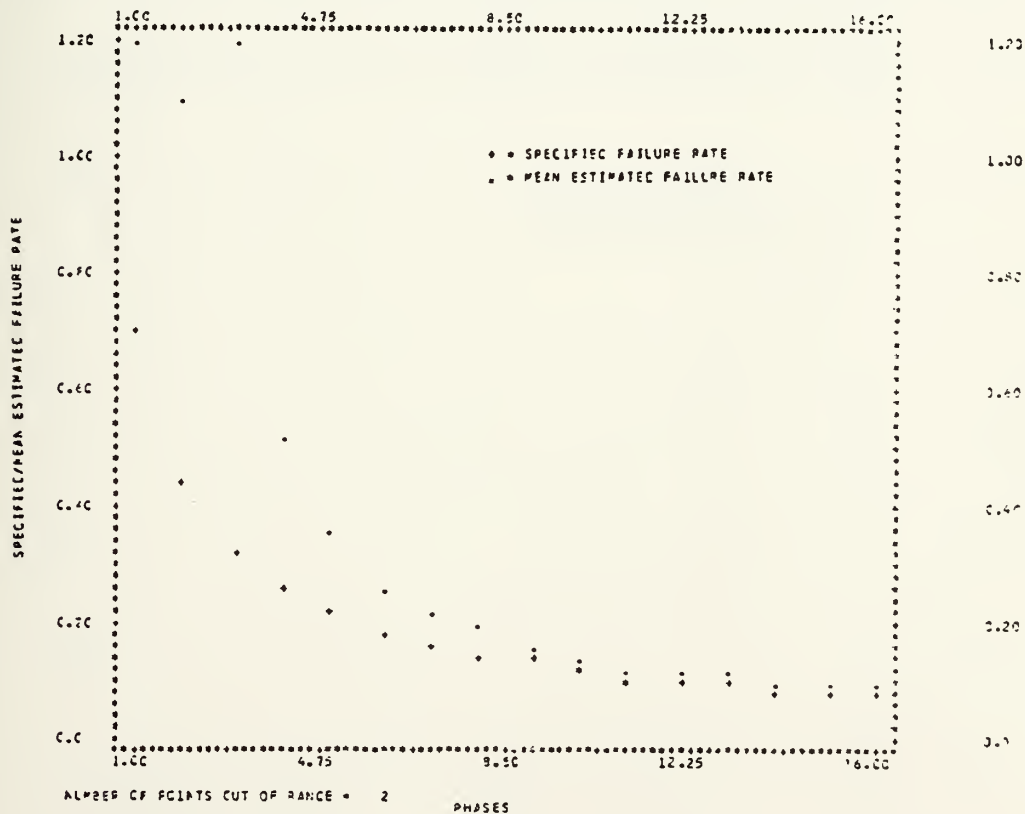


CASE 1

5 ITEMS

| PHASE   | 1      | 2      | 3      | 4      | 5      | 6      | 7      | 8      |
|---|--------|--------|--------|--------|--------|--------|--------|--------|
| ACTUAL FAILURE RATE                                 | 0.7020 | 0.4340 | 0.3200 | 0.2550 | 0.2130 | 0.1630 | 0.1610 | 0.1440 |
| PLANNED TEST TIME                                   | 0.2315 | 0.3745 | 0.5079 | 0.6373 | 0.7630 | 0.8681 | 1.0094 | 1.1286 |
| MODEL ESTIMATE                                      | 2.3197 | 1.1099 | 1.7535 | 0.5154 | 0.3615 | 0.2551 | 0.2240 | 1.1935 |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 230.44 | 155.73 | 447.68 | 102.12 | 69.72  | 39.42  | 35.14  | 34.35  |
| SAMPLE STD DEVIATION                                | 2.1070 | 1.2748 | 7.1630 | 0.5357 | 0.2906 | 0.1362 | 0.1192 | 0.1077 |
| CUMULATIVE TEST TIME                                | 1.081  | 2.822  | 5.140  | 8.035  | 11.513 | 15.614 | 20.248 | 25.447 |
| CUMULATIVE FAILURES                                 | 0.5900 | 1.3100 | 2.0500 | 2.9200 | 3.7700 | 4.5000 | 5.2400 | 5.6000 |

| PHASE   | 9      | 10     | 11     | 12     | 13     | 14      | 15      | 16      |
|---|--------|--------|--------|--------|--------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.1330 | 0.1180 | 0.1090 | 0.1010 | 0.0936 | 0.0876  | 0.0823  | 0.0776  |
| PLANNED TEST TIME                                   | 1.2219 | 1.3773 | 1.4910 | 1.6791 | 1.7363 | 1.3552  | 1.9747  | 2.0745  |
| MODEL ESTIMATE                                      | 0.1563 | 0.1390 | 0.1294 | 0.1178 | 0.1112 | 0.1052  | 0.0993  | 0.0908  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 19.78  | 17.79  | 18.74  | 16.59  | 16.83  | 20.09   | 20.62   | 17.04   |
| SAMPLE STD DEVIATION                                | 0.0378 | 0.0728 | 0.0632 | 0.0557 | 0.0521 | 0.0464  | 0.0457  | 0.0364  |
| CUMULATIVE TEST TIME                                | 31.248 | 37.654 | 44.478 | 51.958 | 55.839 | 68.251  | 77.256  | 86.556  |
| CUMULATIVE FAILURES                                 | 6.5900 | 7.1900 | 8.0000 | 8.7000 | 9.5100 | 10.3200 | 11.1200 | 11.8000 |



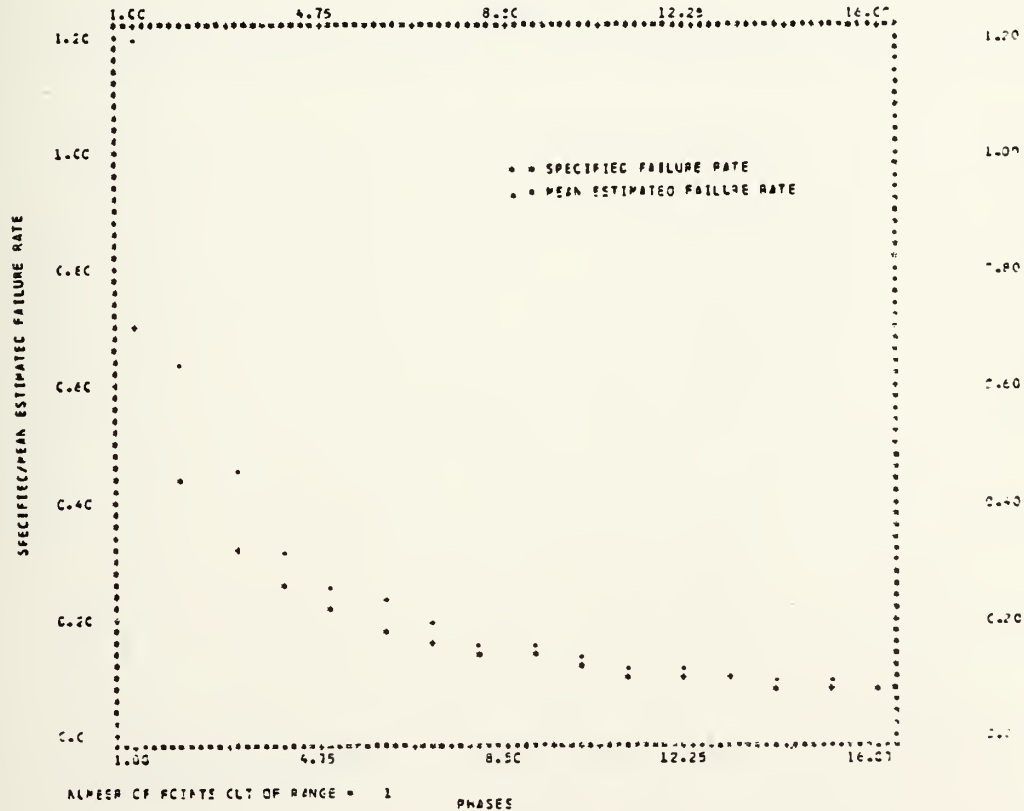


CASE 1

10 ITEMS

| PHASE   | 1       | 2      | 3      | 4      | 5      | 6      | 7       | 8       |
|---|---------|--------|--------|--------|--------|--------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.7020  | 0.4340 | 0.3200 | 0.2550 | 0.2130 | 0.1820 | 0.1610  | 0.1440  |
| PLANNED TEST TIME                                   | 0.2215  | 0.3745 | 0.5079 | 0.6373 | 0.7630 | 0.8881 | 1.0094  | 1.1286  |
| MODEL ESTIMATE                                      | 5.4898  | 0.6376 | 0.4502 | 0.3208 | 0.2581 | 0.2308 | 0.1957  | 0.1691  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 682.03  | 46.51  | 40.70  | 28.16  | 21.16  | 26.14  | 21.53   | 10.75   |
| SAMPLE STD DEVIATION                                | 23.0502 | 0.4566 | 0.3009 | 0.1996 | 0.1228 | 0.1143 | 0.0903  | 0.0685  |
| CUMULATIVE TEST TIME                                | 2.148   | 5.623  | 10.309 | 16.239 | 23.271 | 31.230 | 40.679  | 51.176  |
| CUMULATIVE FAILURES                                 | 1.3300  | 2.8500 | 4.5300 | 5.9300 | 7.4700 | 9.1500 | 10.6200 | 12.0100 |

| PHASE   | 9       | 10      | 11      | 12      | 13      | 14      | 15      | 16      |
|---|---------|---------|---------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.1330  | 0.1180  | 0.1090  | 0.1010  | 0.0936  | 0.0876  | 0.0823  | 0.0776  |
| PLANNED TEST TIME                                   | 1.2219  | 1.3773  | 1.4910  | 1.6391  | 1.7363  | 1.8552  | 1.9747  | 2.0943  |
| MODEL ESTIMATE                                      | 0.1523  | 0.1385  | 0.1246  | 0.1127  | 0.1055  | 0.0977  | 0.0912  | 0.0859  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 14.48   | 17.24   | 14.29   | 11.01   | 12.76   | 11.58   | 10.25   | 10.54   |
| SAMPLE STD DEVIATION                                | 0.0534  | 0.0447  | 0.0367  | 0.0332  | 0.0298  | 0.0265  | 0.0219  | 0.0207  |
| CUMULATIVE TEST TIME                                | 62.421  | 75.054  | 88.887  | 103.821 | 119.802 | 136.857 | 155.102 | 174.540 |
| CUMULATIVE FAILURES                                 | 13.5000 | 15.0600 | 16.4500 | 17.7900 | 19.3500 | 20.8200 | 22.3000 | 23.8000 |





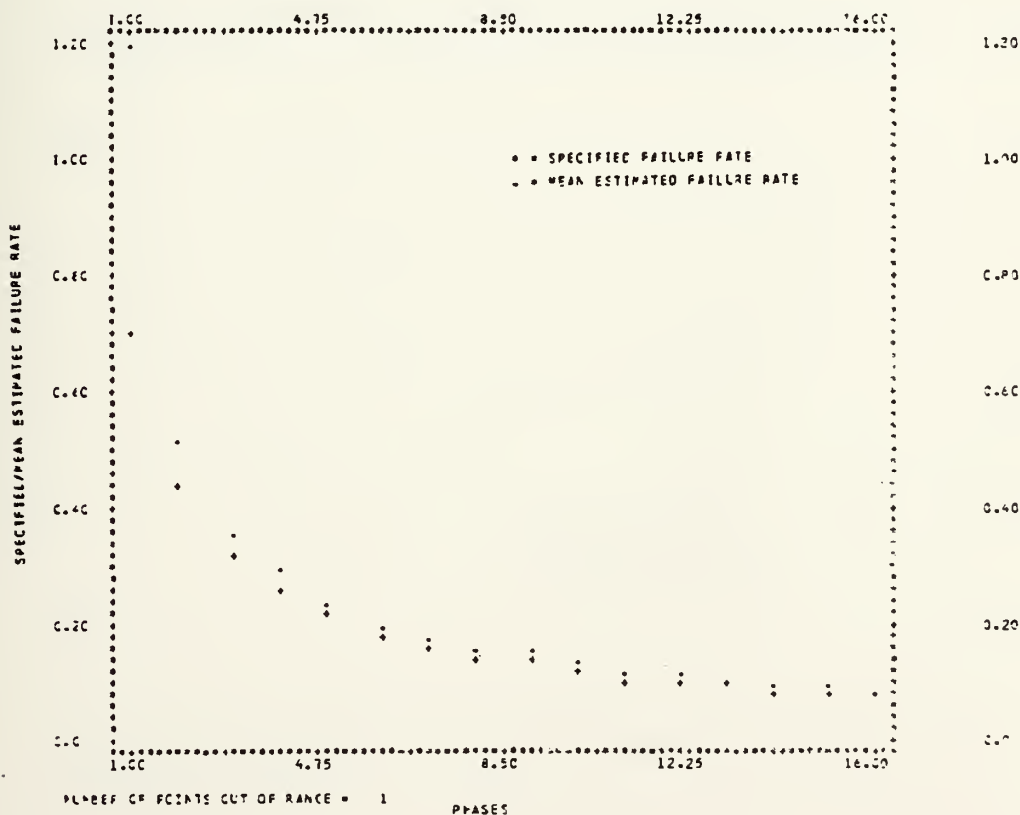


CASE 1

20 ITEMS

| PHASE   | 1      | 2      | 3      | 4       | 5       | 6       | 7       | 8       |
|---|--------|--------|--------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.7020 | 0.4340 | 0.3200 | 0.2550  | 0.2130  | 0.1630  | 0.1610  | 0.1440  |
| PLANNED TEST TIME                                   | 0.2215 | 0.3745 | 0.5079 | 0.6373  | 0.7630  | 0.8881  | 1.0094  | 1.1266  |
| MODEL ESTIMATE                                      | 1.2651 | 0.5279 | 0.3657 | 0.2902  | 0.2438  | 0.2063  | 0.1839  | 0.1631  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 80.22  | 21.64  | 14.27  | 13.82   | 14.47   | 12.72   | 14.21   | 13.24   |
| SAMPLE STD DEVIATION                                | 2.0237 | 0.3178 | 0.1490 | 0.1098  | 0.0852  | 0.0654  | 0.0591  | 0.0491  |
| CUMULATIVE TEST TIME                                | 4.268  | 11.149 | 20.463 | 32.164  | 46.215  | 62.668  | 81.203  | 101.570 |
| CUMULATIVE FAILURES                                 | 3.0200 | 6.0600 | 9.0400 | 11.9900 | 15.0800 | 18.0400 | 21.2300 | 24.2000 |

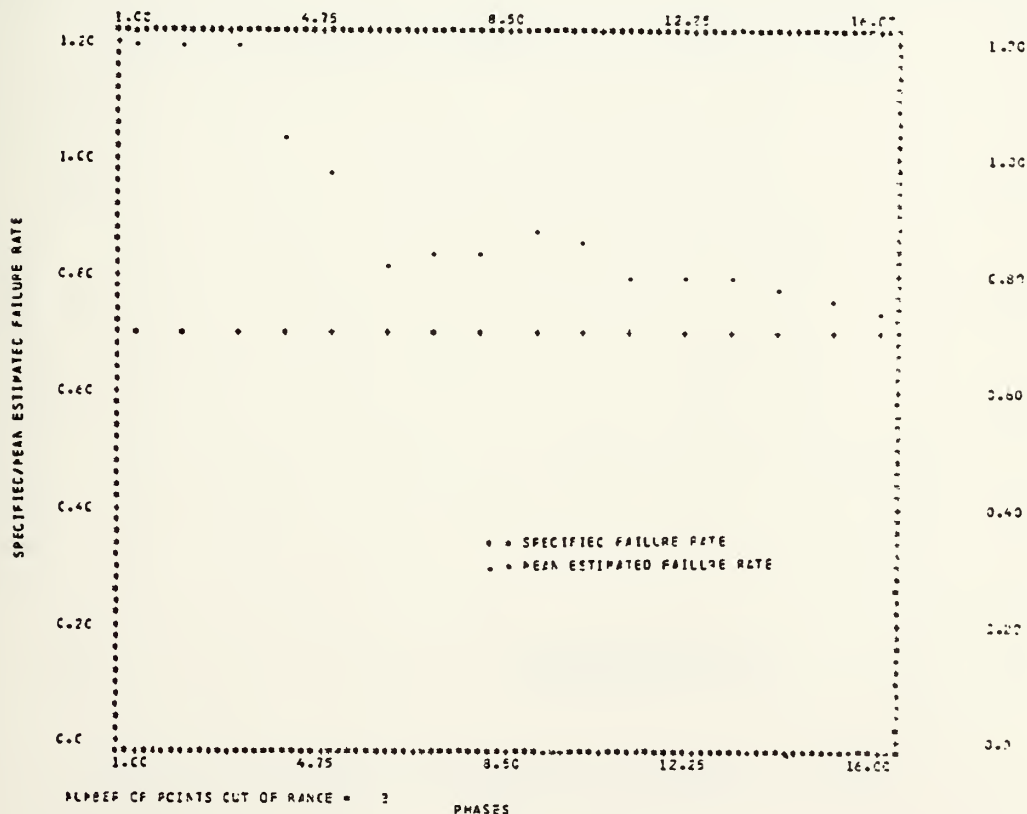
| PHASE   | 9       | 10      | 11      | 12      | 13      | 14      | 15      | 16      |
|---|---------|---------|---------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.1030  | 0.1160  | 0.1090  | 0.1010  | 0.0930  | 0.0876  | 0.0873  | 0.0776  |
| PLANNED TEST TIME                                   | 1.2215  | 1.3773  | 1.4910  | 1.6091  | 1.7363  | 1.8552  | 1.9747  | 2.0943  |
| MODEL ESTIMATE                                      | 0.1504  | 0.1383  | 0.1228  | 0.1136  | 0.1058  | 0.0993  | 0.0922  | 0.0882  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 13.08   | 17.17   | 12.69   | 12.45   | 13.05   | 13.39   | 11.97   | 13.04   |
| SAMPLE STD DEVIATION                                | 0.0362  | 0.0309  | 0.0253  | 0.0229  | 0.0208  | 0.0186  | 0.0165  | 0.0146  |
| CUMULATIVE TEST TIME                                | 124.427 | 149.585 | 177.291 | 206.990 | 238.784 | 272.785 | 309.339 | 347.506 |
| CUMULATIVE FAILURES                                 | 27.0100 | 30.8600 | 33.5300 | 36.0200 | 39.7000 | 42.6700 | 45.7600 | 49.2200 |





| PHASE   | 1      | 2       | 3      | 4      | 5      | 6      | 7      | 8      |
|---|--------|---------|--------|--------|--------|--------|--------|--------|
| ACTUAL FAILURE RATE                                       | 0.7000 | 0.7000  | 0.7000 | 0.7000 | 0.7000 | 0.7000 | 0.7000 | 0.7000 |
| PLANNED TEST TIME   | 0.2322 | 0.2322  | 0.2322 | 0.2322 | 0.2322 | 0.2322 | 0.2322 | 0.2322 |
| MODEL ESTIMATE  | 2.5820 | 3.6035  | 2.0250 | 1.0389 | 0.5719 | 0.2913 | 0.1425 | 0.0713 |
| ESTIMATE ERROR AS<br>PERCENTAGE OF ACTUAL<br>FAILURE RATE | 268.86 | 414.78  | 189.25 | 48.41  | 28.84  | 17.33  | 18.93  | 15.73  |
| SAMPLE STD DEVIATION                                      | 2.5461 | 13.3555 | 6.3476 | 0.0193 | 0.6982 | 0.5571 | 0.5512 | 0.4569 |
| CUMULATIVE TEST TIME                                      | 1.063  | 2.129   | 3.198  | 4.280  | 5.360  | 6.437  | 7.497  | 8.560  |
| CUMULATIVE FAILURES                                       | 0.7300 | 1.5400  | 2.3400 | 3.0300 | 3.7400 | 4.3300 | 5.2200 | 6.0300 |

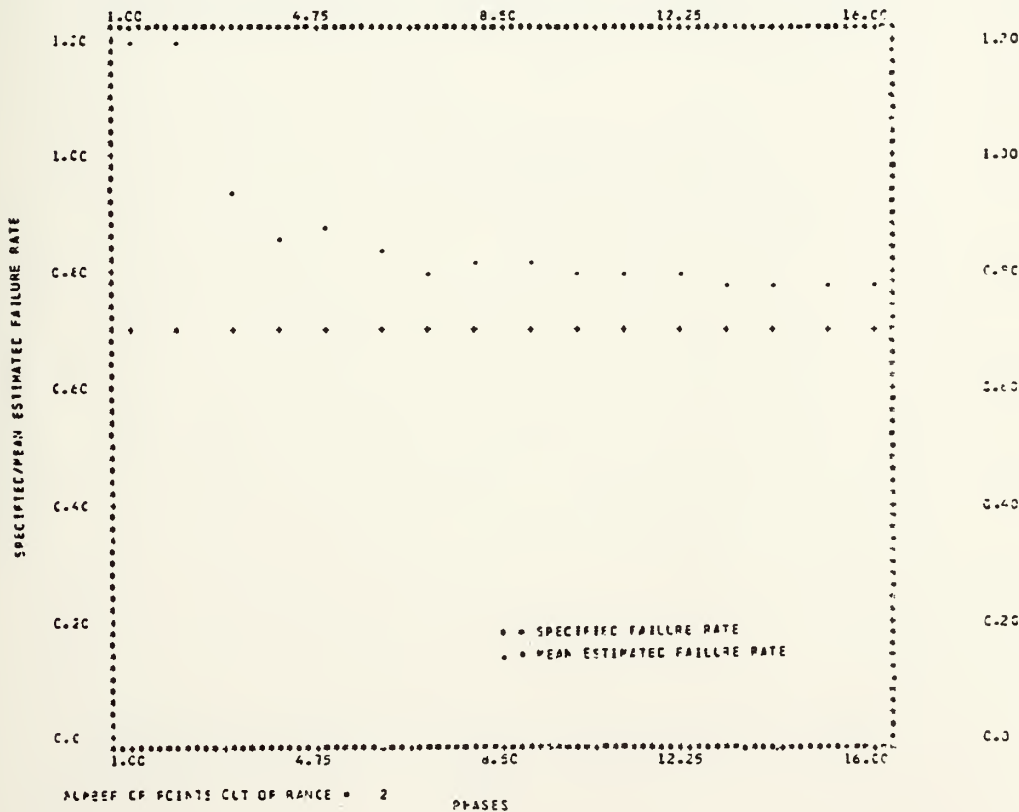
| PHASE   | 9      | 10     | 11     | 12     | 13     | 14      | 15      | 16      |
|---|--------|--------|--------|--------|--------|---------|---------|---------|
| ACTUAL FAILURE RATE                                       | 0.7000 | 0.7000 | 0.7000 | 0.7000 | 0.7000 | 0.7000  | 0.7000  | 0.7000  |
| PLANNED TEST TIME   | 0.2322 | 0.2322 | 0.2322 | 0.2322 | 0.2322 | 0.2322  | 0.2322  | 0.2322  |
| MODEL ESTIMATE  | 0.8858 | 0.8628 | 0.8081 | 0.7941 | 0.7558 | 0.7758  | 0.7532  | 0.7324  |
| ESTIMATE ERROR AS<br>PERCENTAGE OF ACTUAL<br>FAILURE RATE | 26.54  | 24.12  | 15.44  | 13.44  | 13.68  | 11.35   | 7.60    | 5.63    |
| SAMPLE STD DEVIATION                                      | 0.5860 | 0.6019 | 0.4465 | 0.3572 | 0.3992 | 0.3547  | 0.3149  | 0.2960  |
| CUMULATIVE TEST TIME                                      | 9.630  | 10.101 | 11.781 | 12.854 | 13.916 | 14.568  | 16.072  | 17.192  |
| CUMULATIVE FAILURES                                       | 6.8400 | 7.5600 | 8.2100 | 8.9500 | 9.7500 | 10.5500 | 11.2100 | 11.8400 |





| PHASE   | 1      | 2      | 3      | 4      | 5      | 6      | 7       | 8       |
|---|--------|--------|--------|--------|--------|--------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.7000 | 0.7000 | 0.7000 | 0.7000 | 0.7000 | 0.7000  | 0.7000  |
| PLANNED TEST TIME                                   | 0.2322 | 0.2322 | 0.2322 | 0.2322 | 0.2322 | 0.2322 | 0.2322  | 0.2322  |
| MODEL ESTIMATE                                      | 2.0018 | 1.3248 | 0.9434 | 0.8589 | 0.8760 | 0.8474 | 0.8313  | 0.8182  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 185.97 | 89.26  | 34.77  | 22.65  | 25.14  | 21.06  | 14.44   | 16.38   |
| SAMPLE STD DEVIATION                                | 2.6203 | 1.1657 | 0.7177 | 0.5043 | 0.4716 | 0.3547 | 0.3234  | 0.3188  |
| CUMULATIVE TEST TIME                                | 2.195  | 4.285  | 6.451  | 8.597  | 10.720 | 12.877 | 15.016  | 17.148  |
| CUMULATIVE FAILURES                                 | 1.3200 | 3.0600 | 4.3700 | 5.8500 | 7.9800 | 9.0700 | 10.5600 | 12.2600 |

| PHASE   | 9       | 10      | 11      | 12      | 13      | 14      | 15      | 16      |
|---|---------|---------|---------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.7000  | 0.7000  | 0.7000  | 0.7000  | 0.7000  | 0.7000  | 0.7000  | 0.7000  |
| PLANNED TEST TIME                                   | 0.2322  | 0.2322  | 0.2322  | 0.2322  | 0.2322  | 0.2322  | 0.2322  | 0.2322  |
| MODEL ESTIMATE                                      | 0.8184  | 0.7570  | 0.7526  | 0.7919  | 0.7857  | 0.7816  | 0.7787  | 0.7747  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 16.91   | 13.35   | 13.23   | 13.12   | 12.24   | 11.66   | 11.24   | 10.67   |
| SAMPLE STD DEVIATION                                | 0.3175  | 0.2545  | 0.2765  | 0.2506  | 0.2372  | 0.2345  | 0.2367  | 0.2370  |
| CUMULATIVE TEST TIME                                | 19.274  | 21.417  | 23.550  | 25.680  | 27.822  | 29.960  | 32.055  | 34.270  |
| CUMULATIVE FAILURES                                 | 13.8600 | 15.3100 | 16.9100 | 18.5100 | 20.0600 | 21.5900 | 23.1300 | 24.6400 |



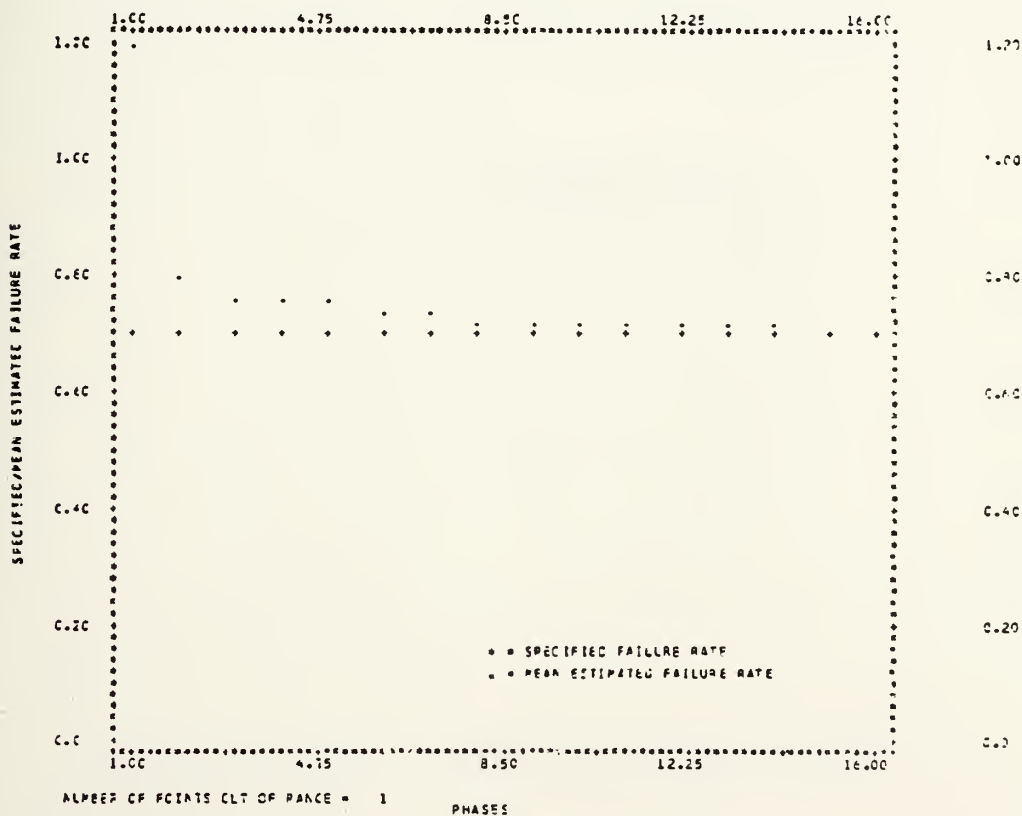


CASE 2

20 ITEMS

| PHASE   | 1      | 2      | 3      | 4       | 5       | 6       | 7       | 8       |
|---|--------|--------|--------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.7000 | 0.7000 | 0.7000  | 0.7000  | 0.7000  | 0.7000  | 0.7000  |
| PLANNED TEST TIME                                   | 0.2322 | 0.2322 | 0.2322 | 0.2322  | 0.2322  | 0.2322  | 0.2322  | 0.2322  |
| MODEL ESTIMATE                                      | 1.3531 | 0.8084 | 0.7636 | 0.7644  | 0.7506  | 0.7411  | 0.7355  | 0.7265  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 93.30  | 15.49  | 9.08   | 5.15    | 7.22    | 5.67    | 5.07    | 3.78    |
| SAMPLE STD DEVIATION                                | 1.5499 | 0.4719 | 0.3593 | 0.2855  | 0.2471  | 0.2083  | 0.1883  | 0.1600  |
| CUMULATIVE TEST TIME                                | 4.236  | 8.548  | 12.802 | 17.075  | 21.356  | 25.638  | 29.979  | 34.233  |
| CUMULATIVE FAILURES                                 | 3.3600 | 6.1400 | 9.1000 | 12.3100 | 15.3800 | 18.4400 | 21.5100 | 24.4100 |

| PHASE   | 9       | 10      | 11      | 12      | 13      | 14      | 15      | 16      |
|---|---------|---------|---------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.7000  | 0.7000  | 0.7000  | 0.7000  | 0.7000  | 0.7000  | 0.7000  | 0.7000  |
| PLANNED TEST TIME                                   | 0.2322  | 0.2322  | 0.2322  | 0.2322  | 0.2322  | 0.2322  | 0.2322  | 0.2322  |
| MODEL ESTIMATE                                      | 0.7158  | 0.7141  | 0.7155  | 0.7197  | 0.7158  | 0.7181  | 0.7356  | 0.7257  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 2.25    | 2.01    | 2.78    | 2.81    | 2.26    | 2.58    | 1.37    | 0.81    |
| SAMPLE STD DEVIATION                                | 0.1755  | 0.1812  | 0.1664  | 0.1820  | 0.1608  | 0.1567  | 0.1402  | 0.1365  |
| CUMULATIVE TEST TIME                                | 38.532  | 42.403  | 47.066  | 51.357  | 55.636  | 59.926  | 64.236  | 68.542  |
| CUMULATIVE FAILURES                                 | 27.3100 | 30.2600 | 33.3900 | 36.4500 | 39.4700 | 42.6100 | 45.4500 | 48.3600 |





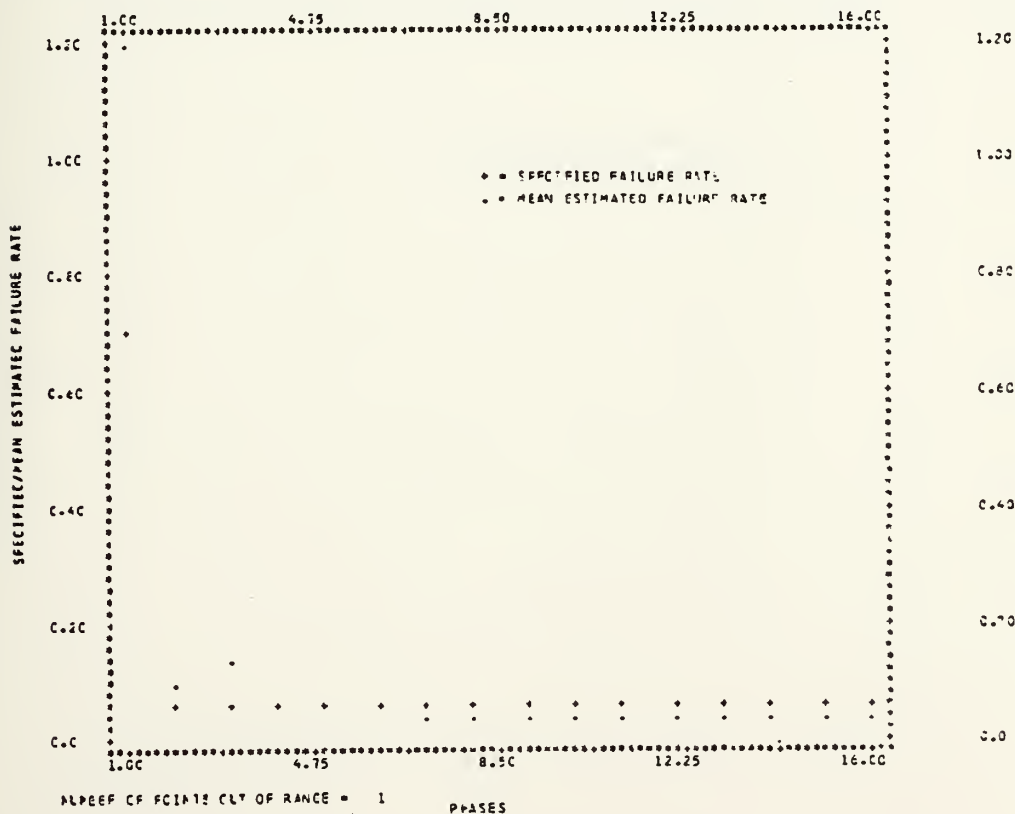


CASE 3

5 ITEMS

| PHASE   | 1      | 2      | 3      | 4      | 5      | 6      | 7      | 8       |
|---|--------|--------|--------|--------|--------|--------|--------|---------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.0500 | 0.0500 | 0.0500 | 0.0500 | 0.0500 | 0.0500 | 0.0500  |
| PLANNED TEST TIME                                   | 0.2322 | 3.2504 | 3.2504 | 3.2504 | 3.2504 | 3.2504 | 3.2504 | 3.2504  |
| MODEL ESTIMATE                                      | 2.6444 | 0.0507 | 0.1386 | 0.0548 | 0.0511 | 0.0526 | 0.0480 | 0.0497  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 277.77 | 81.20  | 177.21 | 9.64   | 2.17   | 5.28   | 4.01   | 1.55    |
| SAMPLE STD DEVIATION                                | 3.0392 | 0.0594 | 0.5117 | 0.0532 | 0.0441 | 0.0452 | 0.0429 | 0.0643  |
| CUMULATIVE TEST TIME                                | 1.065  | 15.995 | 30.968 | 46.032 | 60.971 | 75.892 | 91.011 | 106.100 |
| CUMULATIVE FAILURES                                 | 0.6500 | 1.8200 | 2.3100 | 2.9200 | 3.7000 | 4.4500 | 5.1500 | 5.8300  |

| PHASE   | 9       | 10      | 11      | 12      | 13      | 14      | 15      | 16      |
|---|---------|---------|---------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.0500  | 0.0500  | 0.0500  | 0.0500  | 0.0500  | 0.0500  | 0.0500  | 0.0500  |
| PLANNED TEST TIME                                   | 3.2504  | 3.2504  | 3.2504  | 3.2504  | 3.2504  | 3.2504  | 3.2504  | 3.2504  |
| MODEL ESTIMATE                                      | 0.0454  | 0.0422  | 0.0425  | 0.0423  | 0.0434  | 0.0453  | 0.0453  | 0.0445  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 9.28    | 15.98   | 14.94   | 15.46   | 12.25   | 9.28    | 9.48    | 11.06   |
| SAMPLE STD DEVIATION                                | 0.0317  | 0.0262  | 0.0261  | 0.0253  | 0.0232  | 0.0221  | 0.0209  | 0.0196  |
| CUMULATIVE TEST TIME                                | 121.177 | 136.406 | 151.504 | 166.455 | 181.280 | 196.131 | 211.027 | 226.018 |
| CUMULATIVE FAILURES                                 | 6.5600  | 7.1200  | 7.8700  | 8.6500  | 9.9100  | 10.4500 | 11.2100 | 11.8700 |



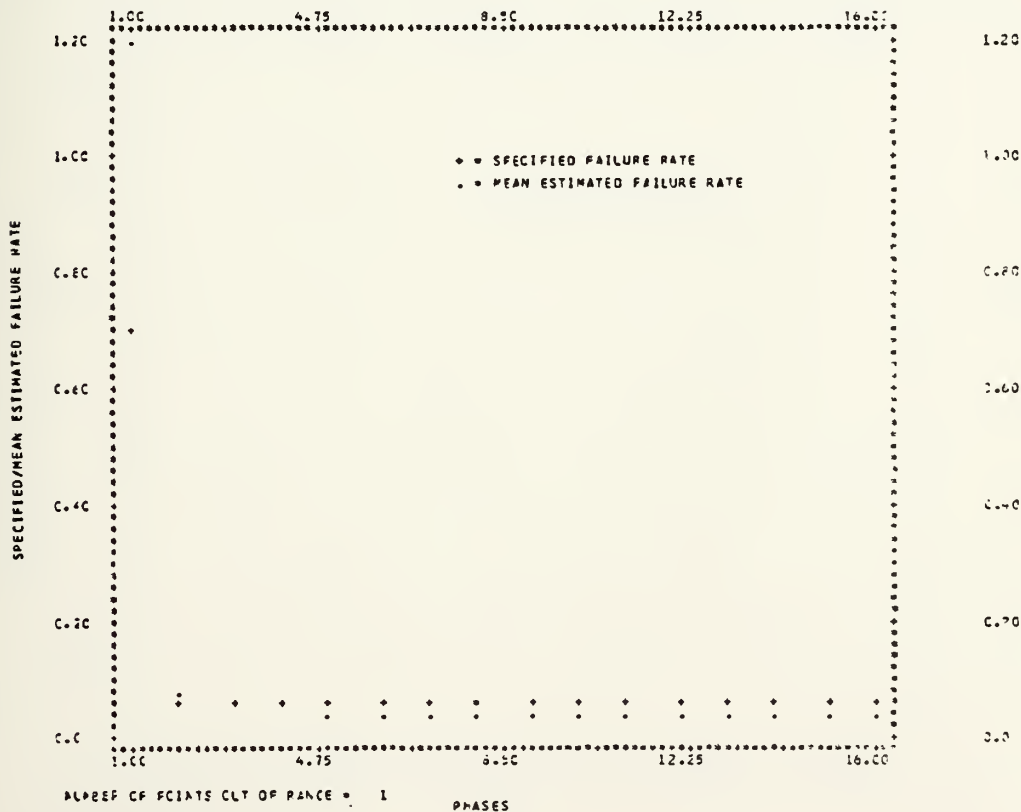


CASE 3

10 ITEMS

| PHASE   | 1      | 2      | 3      | 4      | 5       | 6       | 7       | 8       |
|---|--------|--------|--------|--------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.0900 | 0.0500 | 0.0500 | 0.0500  | 0.0500  | 0.0500  | 0.0500  |
| PLANNED TEST TIME                                   | 0.2322 | 3.2504 | 3.2504 | 3.2504 | 3.2504  | 3.2504  | 3.2504  | 3.2504  |
| MODEL ESTIMATE                                      | 1.6357 | 0.0818 | 0.0607 | 0.0541 | 0.0482  | 0.0468  | 0.0429  | 0.0444  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 133.6E | 63.55  | 21.37  | 8.20   | 3.50    | 6.31    | 14.12   | 17.17   |
| SAMPLE STD DEVIATION                                | 1.5047 | 0.0604 | 0.0518 | 0.0457 | 0.0265  | 0.0253  | 0.0197  | 0.0192  |
| CUMULATIVE TEST TIME                                | 2.157  | 31.678 | 61.491 | 91.432 | 121.048 | 150.665 | 181.030 | 210.614 |
| CUMULATIVE FAILURES                                 | 1.3400 | 3.1500 | 4.8300 | 6.4000 | 7.9500  | 9.8200  | 10.8300 | 12.4800 |

| PHASE   | 9       | 10      | 11      | 12      | 13      | 14      | 15      | 16      |
|---|---------|---------|---------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.0500  | 0.0500  | 0.0500  | 0.0500  | 0.0500  | 0.0500  | 0.0500  | 0.0500  |
| PLANNED TEST TIME                                   | 3.2504  | 3.2504  | 3.2504  | 3.2504  | 3.2504  | 3.2504  | 3.2504  | 3.2504  |
| MODEL ESTIMATE                                      | 0.0441  | 0.0438  | 0.0430  | 0.0432  | 0.0436  | 0.0450  | 0.0456  | 0.0457  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 11.80   | 12.42   | 14.05   | 13.50   | 12.86   | 10.00   | 8.88    | 9.71    |
| SAMPLE STD DEVIATION                                | 0.0201  | 0.0177  | 0.0177  | 0.0174  | 0.0177  | 0.0194  | 0.0193  | 0.0192  |
| CUMULATIVE TEST TIME                                | 240.918 | 270.784 | 301.220 | 331.226 | 360.931 | 390.671 | 420.553 | 450.738 |
| CUMULATIVE FAILURES                                 | 13.9200 | 15.4400 | 16.7500 | 18.2800 | 19.8300 | 21.5300 | 23.1700 | 24.6500 |



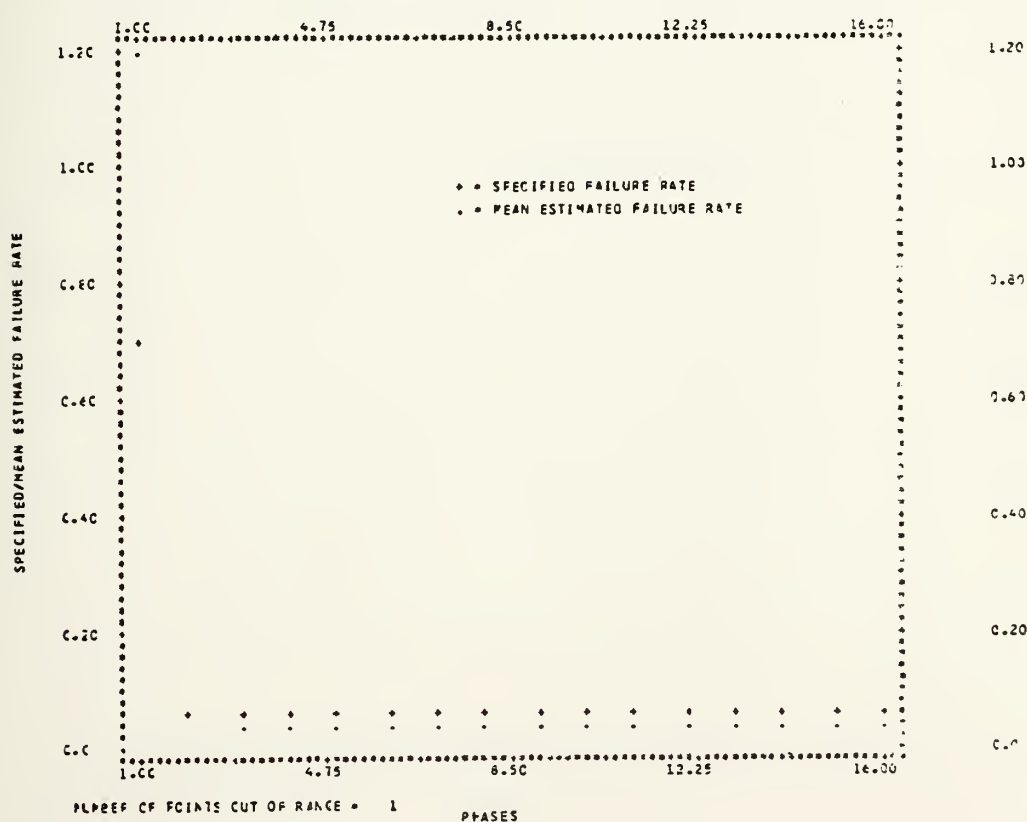


CASE 3

20 STEPS

| PHASE   | 1      | 2      | 3       | 4       | 5       | 6       | 7       | 8       |
|---|--------|--------|---------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.0700 | 0.0500 | 0.0500  | 0.0500  | 0.0500  | 0.0500  | 0.0500  | 0.0500  |
| PLANNED TEST TIME                                   | 0.2322 | 3.2504 | 3.2504  | 3.2504  | 3.2504  | 3.2504  | 3.2504  | 3.2504  |
| MODEL ESTIMATE                                      | 1.2922 | 0.0545 | 0.0395  | 0.0392  | 0.0401  | 0.0400  | 0.0400  | 0.0400  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 84.61  | 9.08   | 21.05   | 21.53   | 19.81   | 20.06   | 20.09   | 18.48   |
| SAMPLE STD DEVIATION                                | 1.8262 | 0.0438 | 0.0176  | 0.0142  | 0.0169  | 0.0141  | 0.0129  | 0.0121  |
| CUMULATIVE TEST TIME                                | 4.323  | 64.115 | 124.571 | 164.251 | 244.255 | 304.437 | 364.496 | 424.273 |
| CUMULATIVE FAILURES                                 | 2.7500 | 5.8100 | 8.6700  | 11.9000 | 14.9400 | 17.9100 | 20.9100 | 24.0700 |

| PHASE   | 9       | 10      | 11      | 12      | 13      | 14      | 15      | 16      |
|---|---------|---------|---------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.0500  | 0.0500  | 0.0500  | 0.0500  | 0.0500  | 0.0500  | 0.0500  | 0.0500  |
| PLANNED TEST TIME                                   | 3.2504  | 3.2504  | 3.2504  | 3.2504  | 3.2504  | 3.2504  | 3.2504  | 3.2504  |
| MODEL ESTIMATE                                      | 0.0406  | 0.0405  | 0.0413  | 0.0415  | 0.0425  | 0.0425  | 0.0423  | 0.0425  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 18.84   | 18.90   | 17.39   | 17.06   | 15.04   | 15.04   | 15.47   | 15.06   |
| SAMPLE STD DEVIATION                                | 0.0110  | 0.0108  | 0.0105  | 0.0103  | 0.0111  | 0.0110  | 0.0108  | 0.0112  |
| CUMULATIVE TEST TIME                                | 434.635 | 545.173 | 604.725 | 665.234 | 724.717 | 784.725 | 844.900 | 905.235 |
| CUMULATIVE FAILURES                                 | 25.9400 | 29.8000 | 32.9300 | 35.8900 | 39.1000 | 41.9900 | 44.7300 | 47.6600 |



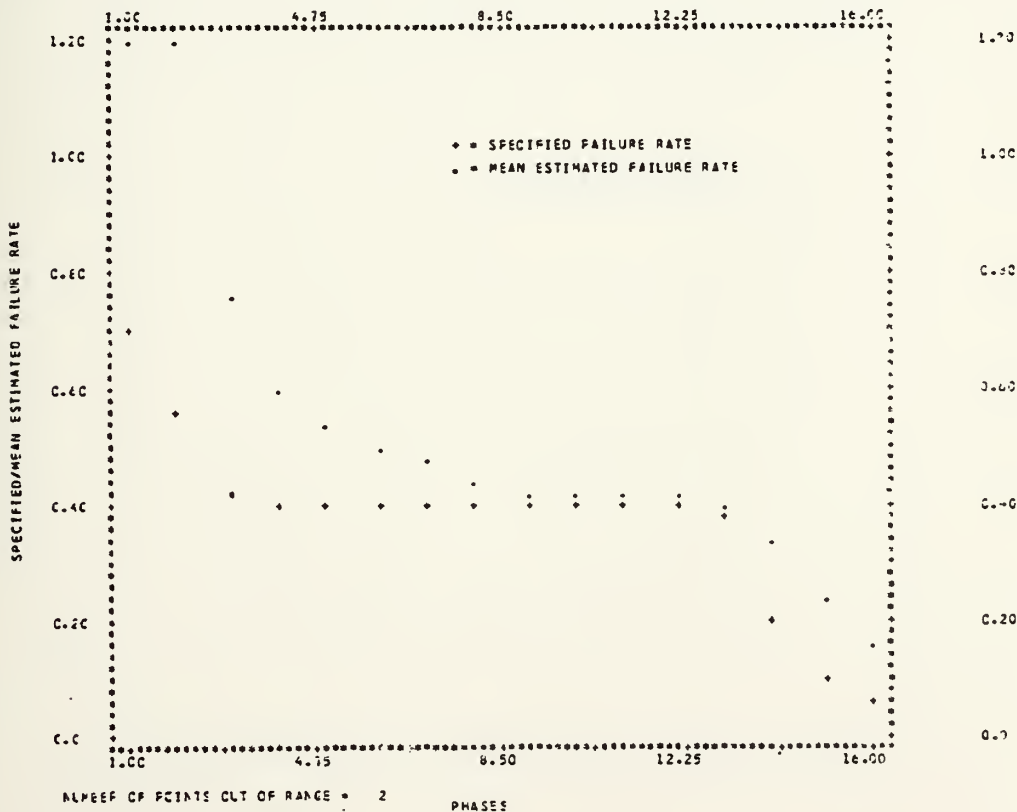


CASE 4

5 ITEMS

| PHASE   | 1      | 2      | 3      | 4      | 5      | 6      | 7      | 8      |
|---|--------|--------|--------|--------|--------|--------|--------|--------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.5500 | 0.4250 | 0.4050 | 0.4000 | 0.4000 | 0.4000 | 0.4000 |
| PLANNED TEST TIME                                   | 0.2222 | 0.2553 | 0.3824 | 0.4013 | 0.4063 | 0.4063 | 0.4063 | 0.4063 |
| MCCEL ESTIMATE                                      | 3.4375 | 1.8021 | 0.7642 | 0.5960 | 0.5432 | 0.4942 | 0.4825 | 0.4354 |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 351.08 | 227.66 | 79.81  | 47.15  | 25.83  | 23.56  | 20.73  | 8.96   |
| SAMPLE STD DEVIATION                                | 6.9796 | 2.3862 | 0.7915 | 0.4336 | 0.4800 | 0.4704 | 0.2864 | 0.2626 |
| CUMULATIVE TEST TIME                                | 1.074  | 2.418  | 4.202  | 6.049  | 7.942  | 9.243  | 11.657 | 13.580 |
| CUMULATIVE FAILURES                                 | 0.6400 | 1.1100 | 2.1100 | 2.9100 | 3.6300 | 4.2700 | 5.0700 | 5.7700 |

| PHASE   | 9      | 10     | 11     | 12     | 13     | 14      | 15      | 16      |
|---|--------|--------|--------|--------|--------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.4000 | 0.4000 | 0.4000 | 0.4000 | 0.3750 | 0.2000  | 0.1000  | 0.0500  |
| PLANNED TEST TIME                                   | 0.4063 | 0.4063 | 0.4063 | 0.4063 | 0.4334 | 0.6126  | 1.6252  | 3.2504  |
| MCCEL ESTIMATE                                      | 0.4266 | 0.4259 | 0.4159 | 0.4204 | 0.4005 | 0.2356  | 0.2499  | 0.1550  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 6.65   | 6.49   | 4.97   | 5.11   | 6.79   | 69.81   | 149.89  | 229.98  |
| SAMPLE STD DEVIATION                                | 0.2152 | 0.1563 | 0.1891 | 0.1981 | 0.2027 | 0.1482  | 0.0977  | 0.0567  |
| CUMULATIVE TEST TIME                                | 15.442 | 17.319 | 19.186 | 21.049 | 23.079 | 26.860  | 34.976  | 45.304  |
| CUMULATIVE FAILURES                                 | 6.5600 | 7.3600 | 8.0700 | 8.7800 | 9.3800 | 10.0600 | 10.8900 | 11.6400 |

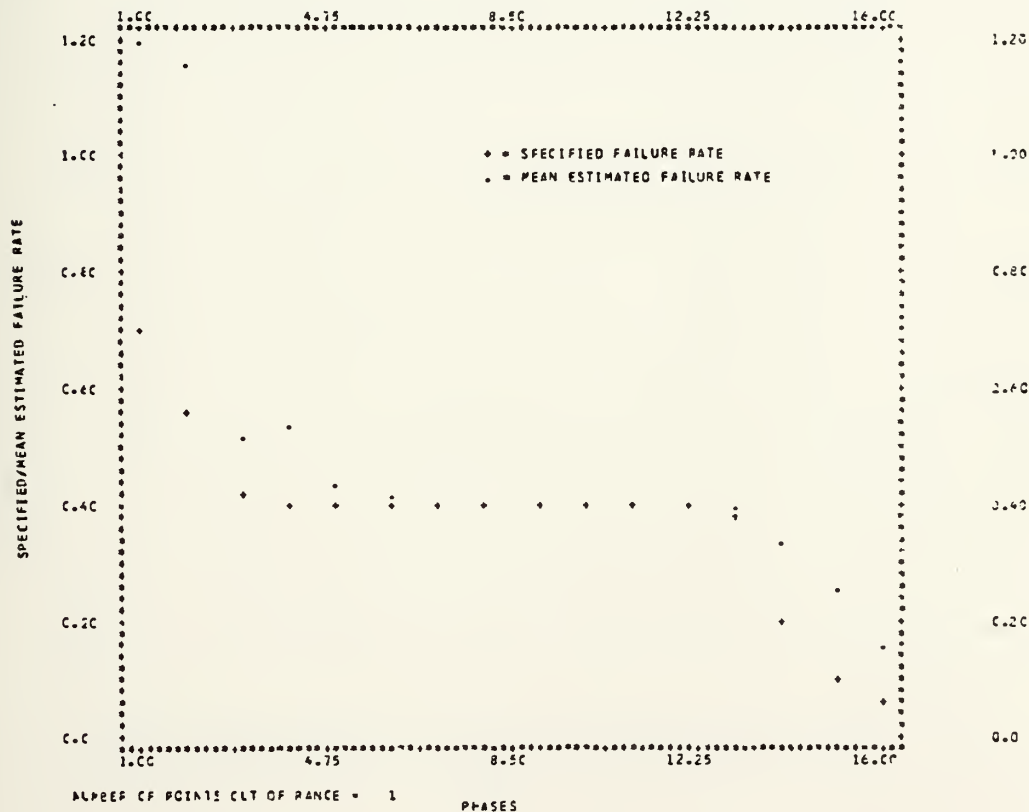






| PHASE   | 1      | 2      | 3      | 4      | 5      | 6      | 7       | 8       |
|---|--------|--------|--------|--------|--------|--------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.5500 | 0.4250 | 0.4050 | 0.4000 | 0.4000 | 0.4000  | 0.4000  |
| PLANNED TEST TIME                                   | 0.2322 | 0.2555 | 0.3824 | 0.4013 | 0.4063 | 0.4063 | 0.4063  | 0.4063  |
| MODEL ESTIMATE                                      | 2.9552 | 1.1648 | 0.5144 | 0.5460 | 0.4436 | 0.4138 | 0.3954  | 0.3957  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 322.75 | 111.77 | 21.03  | 34.81  | 10.90  | 3.45   | 0.16    | 1.08    |
| SAMPLE STD DEVIATION                                | 7.4950 | 3.2214 | 0.3513 | 0.5257 | 0.7224 | 0.7165 | 0.1741  | 0.1626  |
| CUMULATIVE TEST TIME                                | 2.136  | 4.687  | 8.462  | 12.133 | 15.863 | 19.623 | 23.410  | 27.199  |
| CUMULATIVE FAILURES                                 | 1.5400 | 2.9400 | 4.1400 | 5.8600 | 7.3100 | 8.6400 | 10.1000 | 11.5900 |

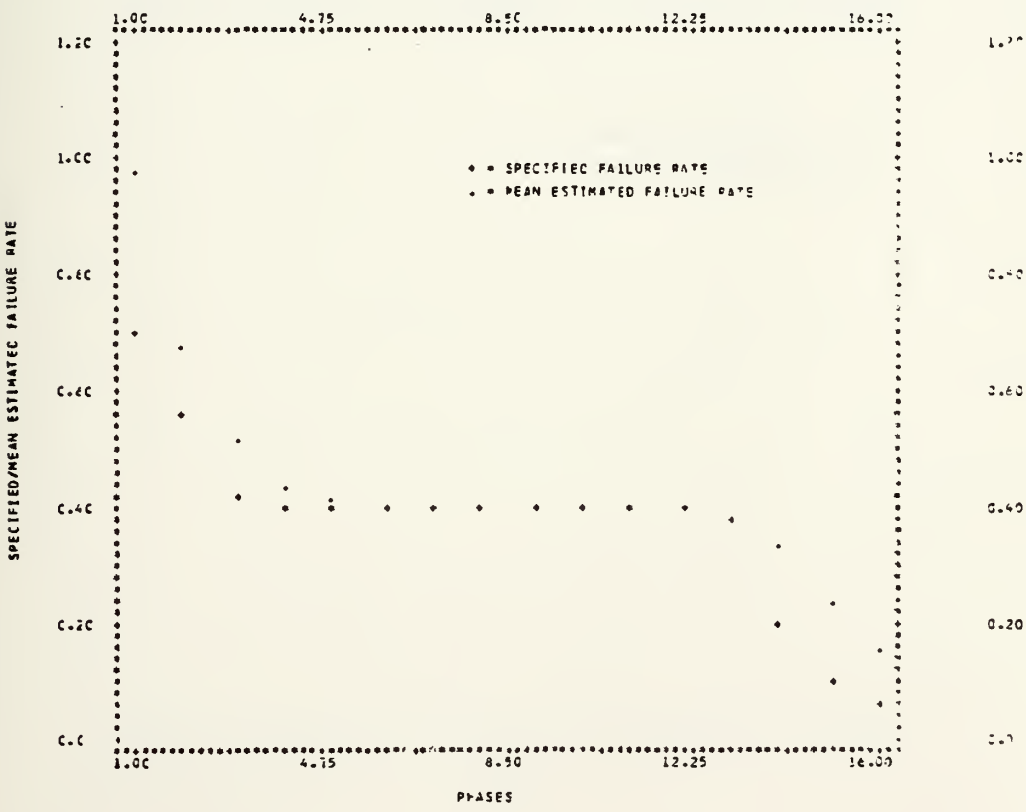
| PHASE   | 9       | 10      | 11      | 12      | 13      | 14      | 15      | 16      |
|---|---------|---------|---------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.4000  | 0.4000  | 0.4000  | 0.4000  | 0.3750  | 0.2200  | 0.1000  | 0.0500  |
| PLANNED TEST TIME                                   | 0.4063  | 0.4063  | 0.4063  | 0.4063  | 0.4334  | 0.6126  | 1.6257  | 2.7904  |
| MODEL ESTIMATE                                      | 0.3545  | 0.3527  | 0.3922  | 0.3548  | 0.3931  | 0.3440  | 0.2548  | 0.1571  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 1.27    | 1.84    | 1.70    | 1.31    | 4.84    | 72.02   | 154.81  | 214.20  |
| SAMPLE STD DEVIATION                                | 0.1511  | 0.1524  | 0.1344  | 0.1547  | 0.1175  | 0.0856  | 0.0698  | 0.0333  |
| CUMULATIVE TEST TIME                                | 30.543  | 34.723  | 38.459  | 42.187  | 46.178  | 52.627  | 68.585  | 98.321  |
| CUMULATIVE FAILURES                                 | 13.0700 | 14.4500 | 16.0100 | 17.5700 | 19.1600 | 20.8000 | 22.3600 | 23.9200 |





| PHASE   | 1      | 2      | 3      | 4       | 5       | 6       | 7       | 8       |
|---|--------|--------|--------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.5000 | 0.4250 | 0.4050  | 0.4000  | 0.4000  | 0.4000  | 0.4000  |
| PLANNED TEST TIME                                   | 0.2322 | 0.2955 | 0.3824 | 0.4013  | 0.4063  | 0.4063  | 0.4063  | 0.4063  |
| MODEL ESTIMATE                                      | 0.9732 | 0.6785 | 0.5168 | 0.4366  | 0.4171  | 0.4053  | 0.4017  | 0.4060  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 39.02  | 23.37  | 21.59  | 7.80    | 4.28    | 1.22    | 0.43    | 1.90    |
| SAMPLE STD DEVIATION                                | 0.7062 | 0.4160 | 0.2559 | 0.1704  | 0.1717  | 0.1370  | 0.1267  | 0.1190  |
| CUMULATIVE TEST TIME                                | 4.313  | 9.798  | 16.874 | 24.303  | 31.798  | 36.327  | 46.799  | 54.188  |
| CUMULATIVE FAILURES                                 | 2.9500 | 5.4000 | 8.8700 | 11.7100 | 14.7100 | 17.7600 | 20.8000 | 24.0000 |

| PHASE   | 9       | 10      | 11      | 12      | 13      | 14      | 15      | 16      |
|---|---------|---------|---------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.4000  | 0.4000  | 0.4000  | 0.4000  | 0.3750  | 0.2000  | 0.1000  | 0.0500  |
| PLANNED TEST TIME                                   | 0.4063  | 0.4063  | 0.4063  | 0.4063  | 0.4334  | 0.6126  | 1.6252  | 3.9504  |
| MODEL ESTIMATE                                      | 0.3999  | 0.4033  | 0.3981  | 0.3941  | 0.3861  | 0.2966  | 0.2442  | 0.1879  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 0.03    | 0.83    | 0.48    | 1.49    | 2.97    | 68.29   | 144.21  | 231.76  |
| SAMPLE STD DEVIATION                                | 0.1101  | 0.1160  | 0.1023  | 0.0970  | 0.0918  | 0.0766  | 0.0494  | 0.0272  |
| CUMULATIVE TEST TIME                                | 61.676  | 69.123  | 76.672  | 84.172  | 92.154  | 107.194 | 137.320 | 197.432 |
| CUMULATIVE FAILURES                                 | 27.0400 | 30.2200 | 33.2300 | 36.1700 | 39.0600 | 42.0500 | 44.8000 | 47.8000 |



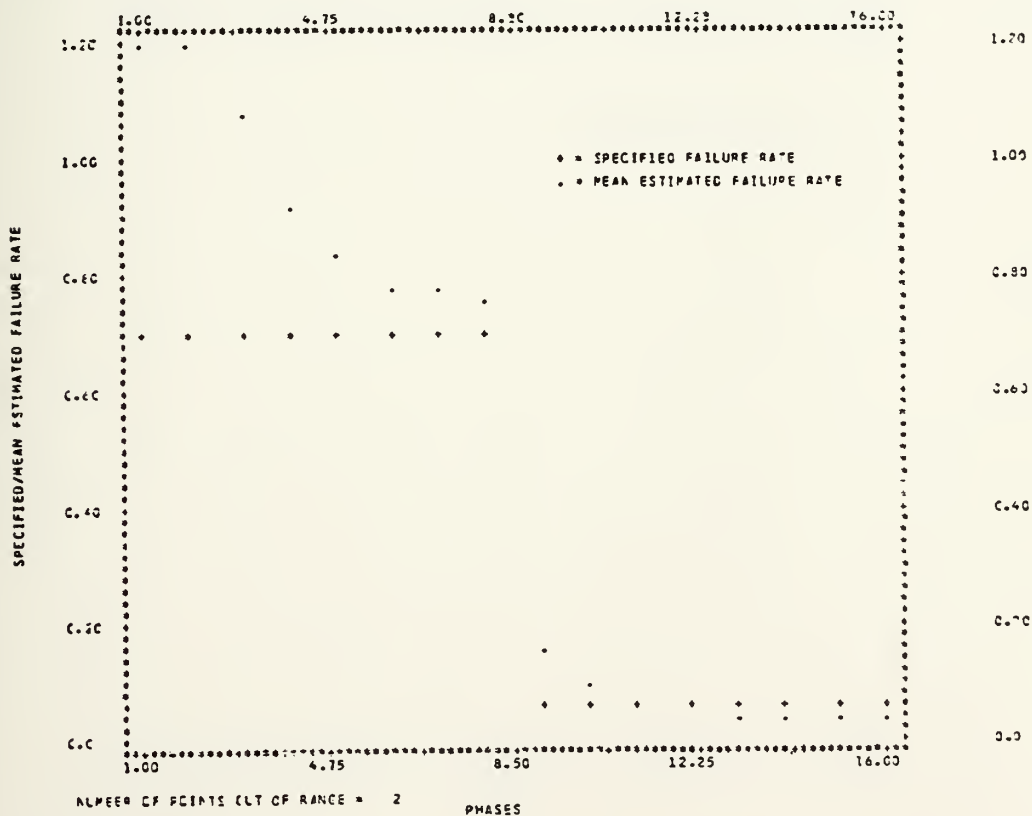


CASE 5

10 ITEMS

| PHASE   | 1      | 2      | 3      | 4      | 5      | 6      | 7      | 8       |
|---|--------|--------|--------|--------|--------|--------|--------|---------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.7000 | 0.7000 | 0.7000 | 0.7000 | 0.7000 | 0.7000 | 0.7000  |
| PLANNED TEST TIME                                   | 0.2322 | 0.2322 | 0.2322 | 0.2322 | 0.2322 | 0.2322 | 0.2322 | 0.2322  |
| MODEL ESTIMATE                                      | 1.4870 | 1.3567 | 1.0846 | 0.9184 | 0.8584 | 0.7754 | 0.7719 | 0.7577  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 112.43 | 93.82  | 54.54  | 31.20  | 19.77  | 10.77  | 10.27  | 8.24    |
| SAMPLE STD DEVIATION                                | 1.2429 | 1.8888 | 0.9333 | 0.6204 | 0.4628 | 0.3504 | 0.3451 | 0.3197  |
| CUMULATIVE TEST TIME                                | 2.160  | 4.312  | 6.455  | 8.509  | 10.704 | 12.932 | 15.076 | 17.222  |
| CUMULATIVE FAILURES                                 | 1.3600 | 2.7200 | 4.0800 | 5.4400 | 6.8000 | 8.1600 | 9.5200 | 10.8800 |

| PHASE   | 9       | 10      | 11      | 12      | 13      | 14      | 15      | 16      |
|---|---------|---------|---------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.0500  | 0.0500  | 0.0500  | 0.0500  | 0.0500  | 0.0500  | 0.0500  | 0.0500  |
| PLANNED TEST TIME                                   | 3.2504  | 3.2504  | 3.2504  | 3.2504  | 3.2504  | 3.2504  | 3.2504  | 3.2504  |
| MODEL ESTIMATE                                      | 0.1580  | 0.0929  | 0.0697  | 0.0565  | 0.0499  | 0.0462  | 0.0438  | 0.0419  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 216.05  | 85.82   | 39.45   | 12.96   | 6.25    | 7.64    | 12.45   | 16.25   |
| SAMPLE STD DEVIATION                                | 0.0502  | 0.0320  | 0.0249  | 0.0188  | 0.0152  | 0.0134  | 0.0122  | 0.0114  |
| CUMULATIVE TEST TIME                                | 47.306  | 77.465  | 107.418 | 137.666 | 167.677 | 197.535 | 227.437 | 257.471 |
| CUMULATIVE FAILURES                                 | 13.0800 | 14.5500 | 16.0300 | 17.2900 | 18.7300 | 20.2400 | 21.6600 | 23.3800 |



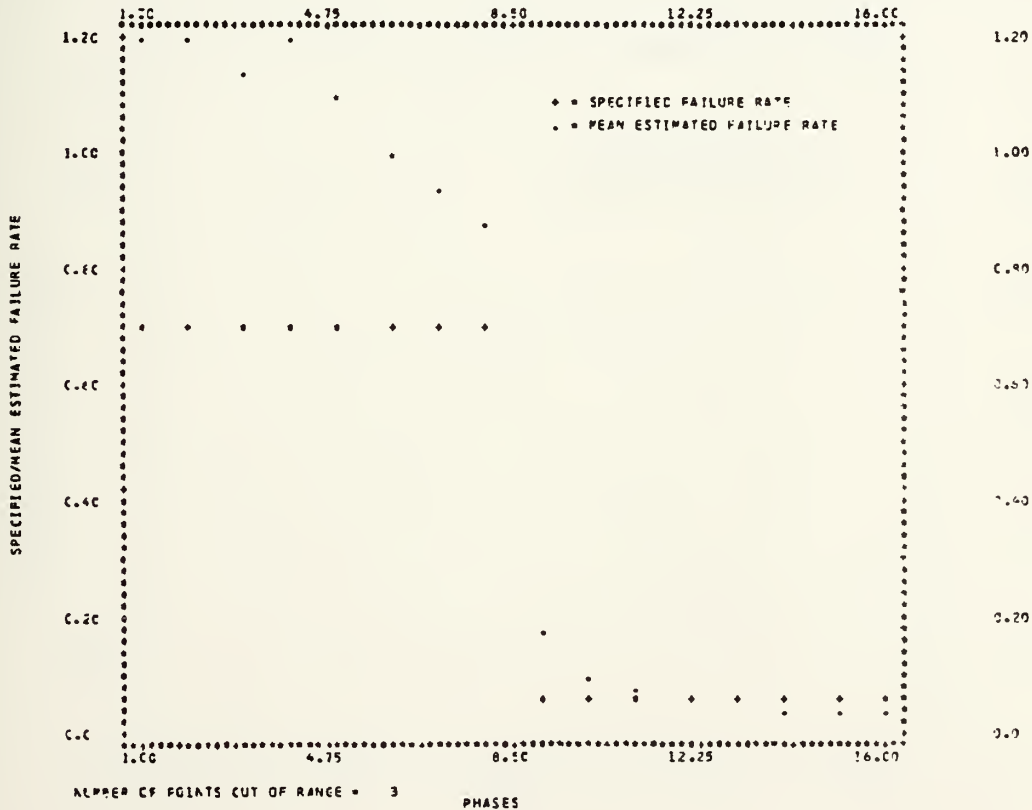


CASE 5

5 ITEMS

| PHASE   | 1       | 2      | 3      | 4      | 5      | 6      | 7      | 8      |
|---|---------|--------|--------|--------|--------|--------|--------|--------|
| ACTUAL FAILURE RATE                                 | 0.7000  | 0.7000 | 0.7000 | 0.7000 | 0.7000 | 0.7000 | 0.7000 | 0.7000 |
| PLANNED TEST TIME                                   | 0.2322  | 0.2322 | 0.2322 | 0.2322 | 0.2322 | 0.2322 | 0.2322 | 0.2322 |
| MODEL ESTIMATE                                      | 7.0034  | 1.7600 | 1.1444 | 1.6976 | 1.0905 | 1.0012 | 0.9440 | 0.8712 |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 500.49  | 151.43 | 63.49  | 142.52 | 55.79  | 42.03  | 34.85  | 24.46  |
| SAMPLE STD DEVIATION                                | 27.8e16 | 1.6287 | 1.0663 | 5.4117 | 0.5275 | 0.7431 | 0.5924 | 0.4657 |
| CUMULATIVE TEST TIME                                | 1.078   | 2.160  | 3.261  | 4.315  | 5.388  | 6.461  | 7.526  | 8.610  |
| CUMULATIVE FAILURES                                 | 0.6000  | 1.3600 | 1.9500 | 2.8400 | 3.5600 | 4.3100 | 5.1700 | 5.8300 |

| PHASE   | 9      | 10     | 11     | 12     | 13     | 14      | 15      | 16      |
|---|--------|--------|--------|--------|--------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.0500 | 0.0500 | 0.0500 | 0.0500 | 0.0500 | 0.0500  | 0.0500  | 0.0500  |
| PLANNED TEST TIME                                   | 3.2504 | 3.2504 | 3.2504 | 3.2504 | 3.2504 | 3.2504  | 3.2504  | 3.2504  |
| MODEL ESTIMATE                                      | 0.1735 | 0.0538 | 0.0710 | 0.0610 | 0.0526 | 0.0488  | 0.0452  | 0.0437  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 247.04 | 87.68  | 41.95  | 22.09  | 5.11   | 2.45    | 6.61    | 12.62   |
| SAMPLE STD DEVIATION                                | 0.1209 | 0.0415 | 0.0288 | 0.0272 | 0.0225 | 0.0211  | 0.0200  | 0.0173  |
| CUMULATIVE TEST TIME                                | 23.741 | 38.931 | 53.903 | 68.700 | 83.815 | 98.725  | 113.771 | 128.757 |
| CUMULATIVE FAILURES                                 | 6.5300 | 7.1500 | 7.9300 | 8.7100 | 9.3700 | 10.1700 | 10.8200 | 11.6700 |





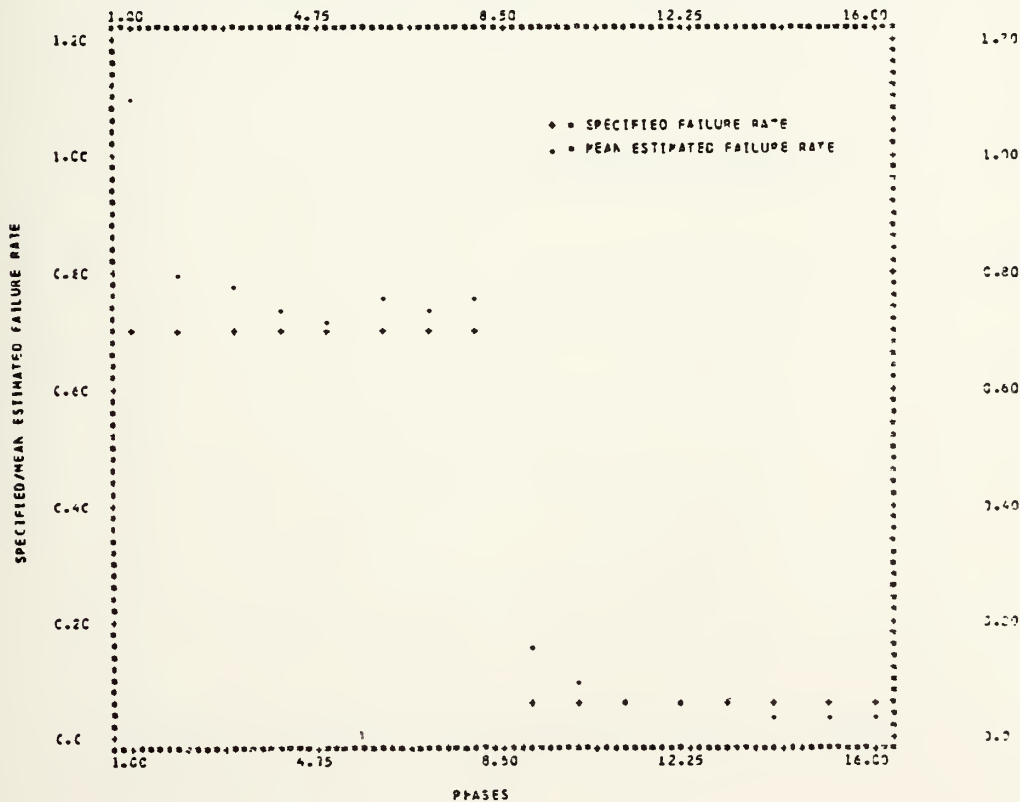


CASE 3

20 ITEMS

| PHASE   | 1      | 2      | 3      | 4       | 5       | 6       | 7       | 8       |
|---|--------|--------|--------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.7000 | 0.7000 | 0.7000  | 0.7000  | 0.7000  | 0.7000  | 0.7000  |
| PLANNED TEST TIME                                   | 0.2322 | 0.2322 | 0.2322 | 0.2322  | 0.2322  | 0.2322  | 0.2322  | 0.2322  |
| MODEL ESTIMATE                                      | 1.0961 | 0.7566 | 0.7845 | 0.7451  | 0.7287  | 0.7515  | 0.7497  | 0.7551  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 56.58  | 13.81  | 12.07  | 6.45    | 4.10    | 7.26    | 7.11    | 7.87    |
| SAMPLE STD DEVIATION                                | 0.8540 | 0.4459 | 0.3028 | 0.3081  | 0.2905  | 0.2900  | 0.2906  | 0.2813  |
| CUMULATIVE TEST TIME                                | 4.238  | 8.596  | 12.902 | 17.214  | 21.527  | 25.794  | 30.060  | 34.330  |
| CUMULATIVE FAILURES                                 | 3.0400 | 5.8000 | 8.8200 | 11.6600 | 14.5700 | 17.8400 | 20.9900 | 24.2300 |

| PHASE   | 9       | 10      | 11      | 12      | 13      | 14      | 15      | 16      |
|---|---------|---------|---------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.0500  | 0.0500  | 0.0500  | 0.0500  | 0.0500  | 0.0500  | 0.0500  | 0.0500  |
| PLANNED TEST TIME                                   | 3.2504  | 3.2504  | 3.2504  | 3.2504  | 3.2504  | 3.2504  | 3.2504  | 3.2504  |
| MODEL ESTIMATE                                      | 0.1618  | 0.0950  | 0.0699  | 0.0585  | 0.0511  | 0.0472  | 0.0438  | 0.0416  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 223.55  | 90.06   | 39.80   | 16.99   | 2.29    | 5.70    | 12.28   | 16.85   |
| SAMPLE STD DEVIATION                                | 0.0377  | 0.0208  | 0.0154  | 0.0137  | 0.0120  | 0.0108  | 0.0095  | 0.0087  |
| CUMULATIVE TEST TIME                                | 94.364  | 154.544 | 214.544 | 274.597 | 335.177 | 394.997 | 455.430 | 515.576 |
| CUMULATIVE FAILURES                                 | 27.1800 | 30.2600 | 32.9500 | 36.0100 | 38.8500 | 41.5900 | 44.2700 | 47.8200 |



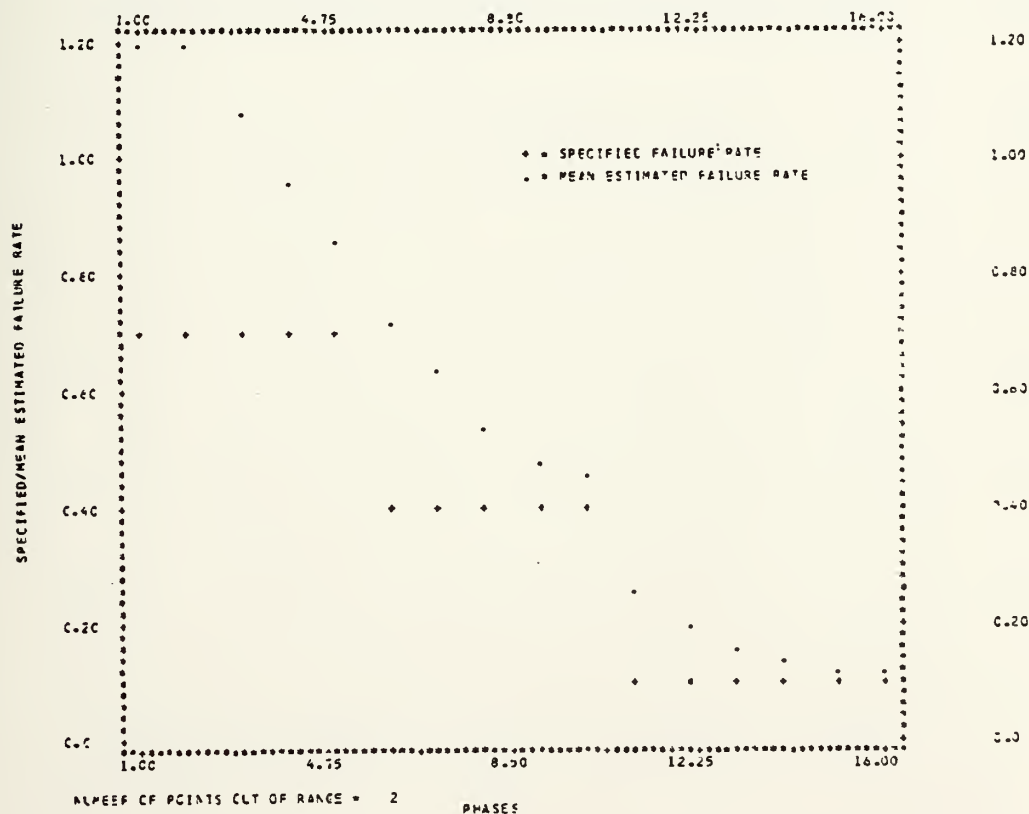


CASE 6

5 ITEMS

| PHASE   | 1       | 2       | 3      | 4      | 5      | 6      | 7      | 8      |
|---|---------|---------|--------|--------|--------|--------|--------|--------|
| ACTUAL FAILURE RATE                                 | 0.7000  | 0.7000  | 0.7000 | 0.7000 | 0.7000 | 0.4000 | 0.4000 | 0.4000 |
| PLANNED TEST TIME                                   | 0.2322  | 0.2322  | 0.2322 | 0.2322 | 0.2322 | 0.4063 | 0.4063 | 0.4063 |
| MODEL ESTIMATE                                      | 8.1372  | 3.2307  | 1.0889 | 0.9994 | 0.8095 | 0.7261 | 0.6197 | 0.5407 |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 1062.49 | 361.53  | 55.59  | 37.35  | 24.22  | 81.53  | 59.54  | 35.05  |
| SAMPLE STD DEVIATION                                | 61.6542 | 12.8530 | 0.8206 | 0.8237 | 0.6671 | 0.5166 | 0.4158 | 0.2592 |
| CUMULATIVE TEST TIME                                | 1.061   | 2.128   | 3.209  | 4.305  | 5.374  | 7.210  | 9.075  | 10.968 |
| CUMULATIVE FAILURES                                 | 0.7400  | 1.4600  | 2.2200 | 2.8400 | 3.5500 | 4.4600 | 5.2600 | 6.0100 |

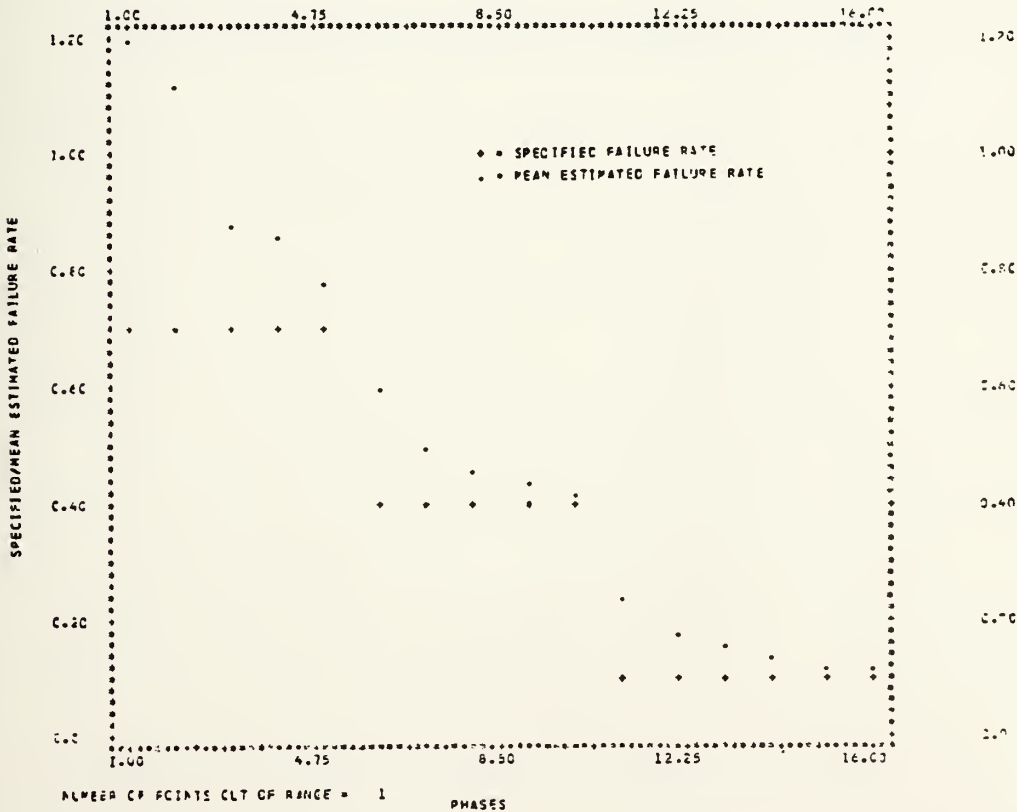
| PHASE   | 9      | 10     | 11     | 12     | 13     | 14      | 15      | 16      |
|---|--------|--------|--------|--------|--------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.4000 | 0.4000 | 0.1000 | 0.1000 | 0.1000 | 0.1000  | 0.1000  | 0.1000  |
| PLANNED TEST TIME                                   | 0.4063 | 0.4063 | 1.6252 | 1.6252 | 1.6252 | 1.6252  | 1.6252  | 1.6252  |
| MODEL ESTIMATE                                      | 0.4852 | 0.4558 | 0.2601 | 0.1951 | 0.1608 | 0.1381  | 0.1281  | 0.1195  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 21.30  | 14.95  | 160.15 | 95.07  | 60.80  | 38.14   | 28.06   | 19.51   |
| SAMPLE STD DEVIATION                                | 0.2159 | 0.2063 | 0.1126 | 0.0776 | 0.0609 | 0.0529  | 0.0478  | 0.0429  |
| CUMULATIVE TEST TIME                                | 12.856 | 14.742 | 22.241 | 29.722 | 37.201 | 44.676  | 52.044  | 59.523  |
| CUMULATIVE FAILURES                                 | 6.6500 | 7.3600 | 8.0900 | 8.9000 | 9.7000 | 10.4000 | 11.3000 | 12.1500 |





| PHASE   | 1      | 2      | 3      | 4      | 5      | 6      | 7      | 8       |
|---|--------|--------|--------|--------|--------|--------|--------|---------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.7000 | 0.7000 | 0.7000 | 0.7000 | 0.4000 | 0.4000 | 0.4000  |
| PLANNED TEST TIME                                   | 0.2322 | 0.2322 | 0.2322 | 0.2322 | 0.2322 | 0.4063 | 0.4063 | 0.4063  |
| MODEL ESTIMATE                                      | 1.7872 | 1.1281 | 0.8811 | 0.8621 | 0.7812 | 0.5577 | 0.5077 | 0.4506  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 155.31 | 61.16  | 25.86  | 23.16  | 11.59  | 45.43  | 76.92  | 17.65   |
| SAMPLE STD DEVIATION                                | 1.7462 | 0.9207 | 0.5558 | 0.4681 | 0.3682 | 0.2647 | 0.2068 | 0.1694  |
| CUMULATIVE TEST TIME                                | 2.158  | 4.277  | 6.441  | 9.553  | 10.729 | 14.459 | 16.267 | 22.093  |
| CUMULATIVE FAILURES                                 | 1.3500 | 3.0100 | 4.3300 | 5.9200 | 7.2400 | 8.6600 | 9.5600 | 11.2500 |

| PHASE   | 9       | 10      | 11      | 12      | 13      | 14      | 15      | 16      |
|---|---------|---------|---------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.4000  | 0.4000  | 0.1000  | 0.1000  | 0.1000  | 0.1000  | 0.1000  | 0.1000  |
| PLANNED TEST TIME                                   | 0.4063  | 0.4063  | 1.6252  | 1.6252  | 1.6252  | 1.6252  | 1.6252  | 1.6252  |
| MODEL ESTIMATE                                      | 0.4355  | 0.4184  | 0.2492  | 0.1883  | 0.1554  | 0.1366  | 0.1236  | 0.1149  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 8.99    | 4.61    | 149.24  | 88.29   | 55.45   | 36.55   | 23.61   | 14.90   |
| SAMPLE STD DEVIATION                                | 0.1644  | 0.1469  | 0.0663  | 0.0576  | 0.0423  | 0.0383  | 0.0295  | 0.0294  |
| CUMULATIVE TEST TIME                                | 25.831  | 29.565  | 44.552  | 59.418  | 74.439  | 85.220  | 104.331 | 119.306 |
| CUMULATIVE FAILURES                                 | 12.7500 | 14.1900 | 15.7600 | 17.4500 | 19.0200 | 20.5800 | 22.1800 | 23.7400 |



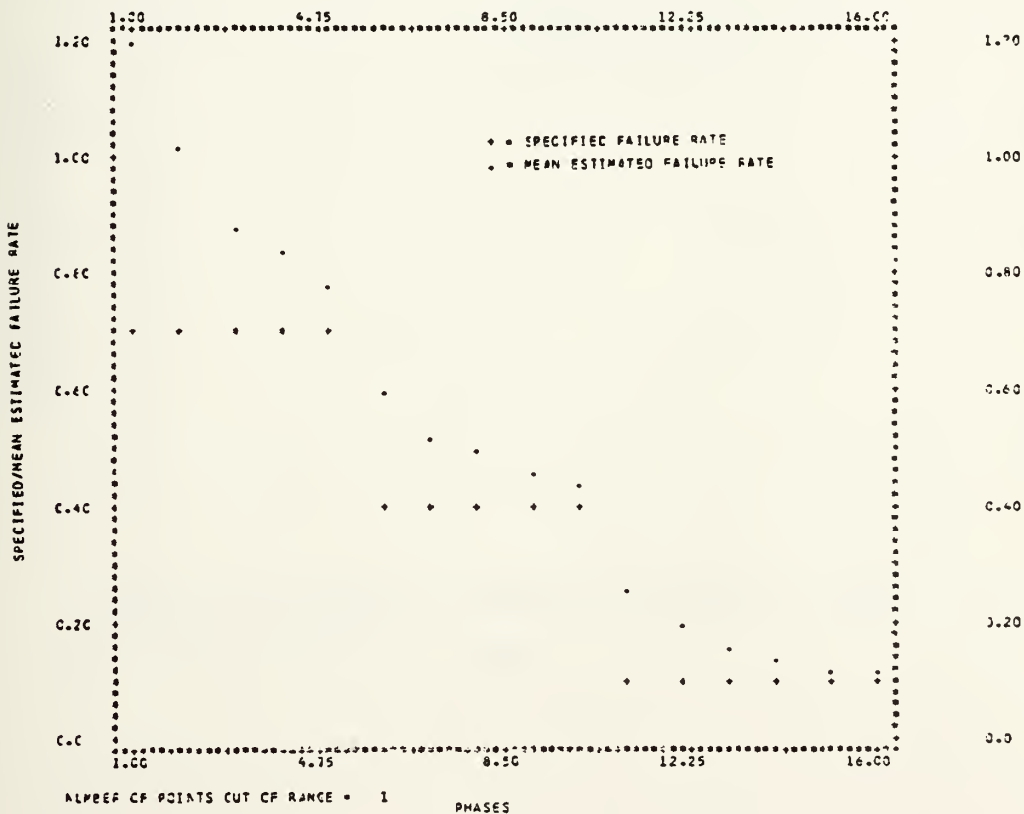


CASE 6

20 ITEMS

| PHASE   | 1      | 2      | 3      | 4      | 5      | 6      | 7      | 8      |
|---|--------|--------|--------|--------|--------|--------|--------|--------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.7000 | 0.7000 | 0.7000 | 0.7000 | 0.4000 | 0.4000 | 0.4000 |
| PLANNED TEST TIME                                   | 0.2322 | 0.2322 | 0.2322 | 0.2322 | 0.2322 | 0.4063 | 0.4063 | 0.4063 |
| MODEL ESTIMATE                                      | 1.2777 | 1.0114 | 0.8886 | 0.8252 | 0.7894 | 0.4063 | 0.5260 | 0.4559 |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 82.53  | 44.48  | 26.94  | 19.32  | 12.78  | 52.08  | 31.49  | 22.96  |
| SAMPLE STD DEVIATION                                | 1.2163 | 0.6270 | 0.4078 | 0.3046 | 0.2523 | 0.1787 | 0.1497 | 0.1374 |
| CUMULATIVE TEST TIME                                | 4.294  | 8.561  | 12.842 | 17.130 | 21.419 | 28.905 | 36.410 | 43.831 |
| CUMULATIVE FAILURES                                 | 2.7700 | 3.0500 | 3.2000 | 3.3000 | 3.4200 | 3.8700 | 4.2000 | 4.3000 |

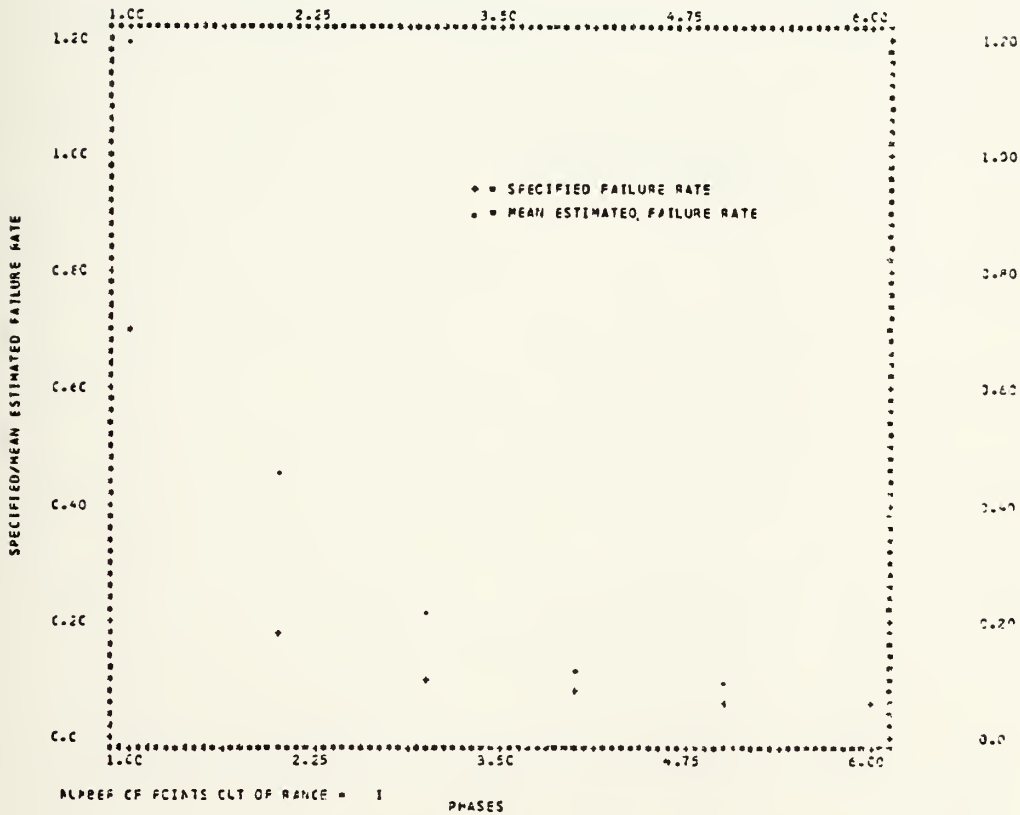
| PHASE   | 9       | 10      | 11      | 12      | 13      | 14      | 15      | 16      |
|---|---------|---------|---------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.4000  | 0.4000  | 0.1000  | 0.1000  | 0.1000  | 0.1000  | 0.1000  | 0.1000  |
| PLANNED TEST TIME                                   | 0.4063  | 0.4063  | 1.0252  | 1.6252  | 1.6252  | 1.6252  | 1.6252  | 1.6252  |
| MODEL ESTIMATE                                      | 0.4551  | 0.4389  | 0.2581  | 0.1931  | 0.1571  | 0.1355  | 0.1213  | 0.1116  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 13.76   | 9.72    | 158.09  | 93.06   | 57.10   | 35.47   | 21.21   | 11.65   |
| SAMPLE STD DEVIATION                                | 0.1217  | 0.1210  | 0.0858  | 0.0431  | 0.0334  | 0.0376  | 0.0241  | 0.0208  |
| CUMULATIVE TEST TIME                                | 51.373  | 58.856  | 88.818  | 118.437 | 148.459 | 178.415 | 208.546 | 238.677 |
| CUMULATIVE FAILURES                                 | 27.0300 | 30.0400 | 33.1700 | 36.4600 | 39.4300 | 42.3500 | 45.7600 | 48.2700 |







| PHASE   | 1      | 2      | 3      | 4      | 5      | 6      |
|---|--------|--------|--------|--------|--------|--------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.1800 | 0.1060 | 0.0760 | 0.0600 | 0.0500 |
| PLANNED TEST TIME                                   | 0.2322 | 0.9029 | 1.5332 | 2.1264 | 2.7066 | 3.2904 |
| MODEL ESTIMATE                                      | 2.6664 | 0.4595 | 0.2102 | 0.1267 | 0.0989 | 0.0648 |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 280.62 | 155.26 | 98.29  | 66.74  | 64.89  | 29.63  |
| SAMPLE STD DEVIATION                                | 2.2451 | 0.3773 | 0.2323 | 0.2691 | 0.1488 | 0.0529 |
| CUMULATIVE TEST TIME                                | 1.082  | 5.233  | 12.335 | 22.415 | 34.919 | 45.500 |
| CUMULATIVE FAILURES                                 | 0.5800 | 1.4000 | 2.1100 | 2.6300 | 3.4500 | 4.2000 |

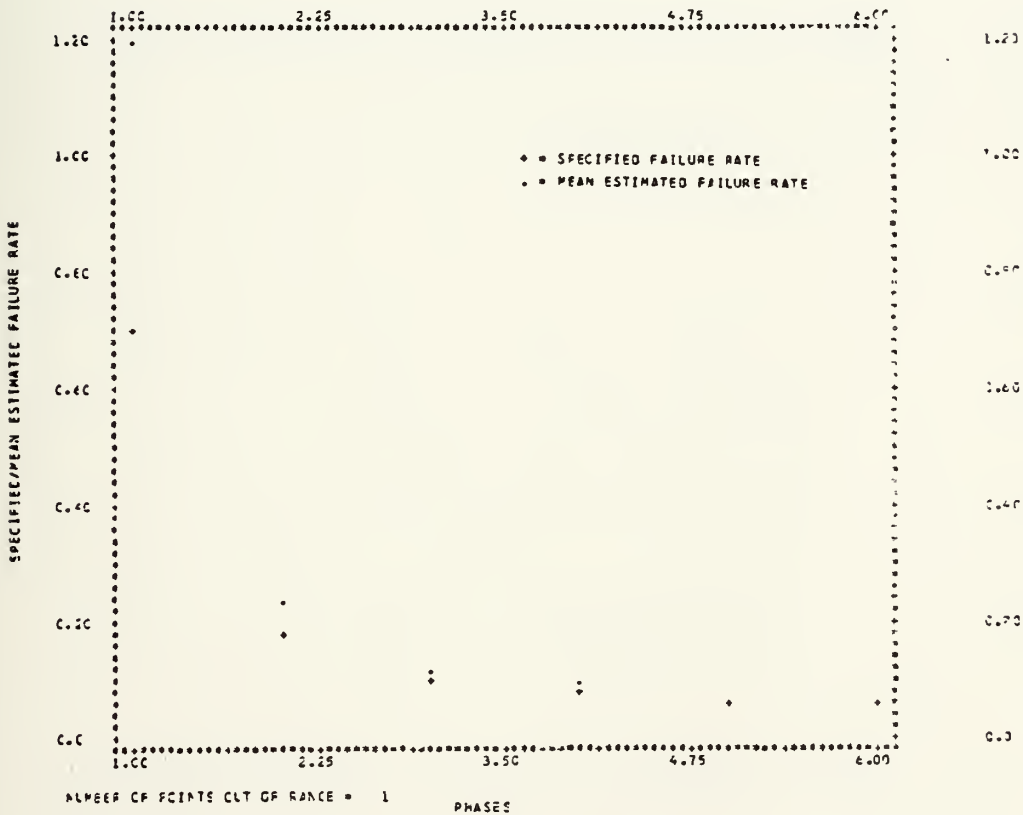




CASE 7

10 ITEMS

| PHASE   | 1      | 2      | 3      | 4      | 5      | 6      |
|---|--------|--------|--------|--------|--------|--------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.1800 | 0.1000 | 0.0700 | 0.0600 | 0.0500 |
| PLANNED TEST TIME                                   | 0.2322 | 0.9029 | 1.5222 | 2.1334 | 2.7086 | 3.2404 |
| MODEL ESTIMATE                                      | 1.4664 | 0.2349 | 0.1188 | 0.0935 | 0.0609 | 0.0525 |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 109.49 | 30.48  | 12.05  | 22.99  | 1.51   | 4.51   |
| SAMPLE STD DEVIATION                                | 1.9720 | 0.1645 | 0.0705 | 0.1258 | 0.0258 | 0.0220 |
| CUMULATIVE TEST TIME                                | 2.131  | 10.442 | 24.658 | 44.542 | 69.742 | 99.645 |
| CUMULATIVE FAILURES                                 | 1.5200 | 3.0500 | 4.5000 | 5.6700 | 7.4000 | 9.0400 |

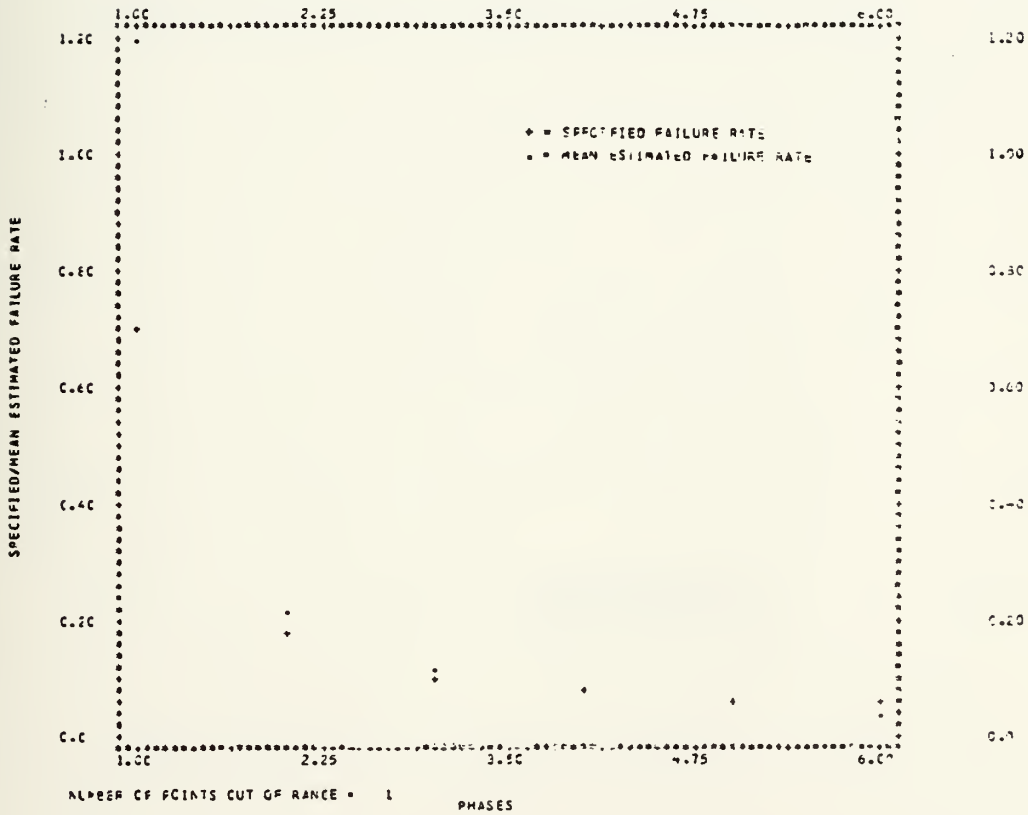




CASE 7

20 ITEMS

| PHASE   | 1      | 2      | 3      | 4       | 5       | 6       |
|---|--------|--------|--------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.1800 | 0.1060 | 0.0760  | 0.0600  | 0.0500  |
| PLANNED TEST TIME                                   | 0.2322 | 0.9029 | 1.5332 | 2.1384  | 2.7086  | 3.2504  |
| MODEL ESTIMATE                                      | 1.2810 | 0.2117 | 0.1117 | 0.0803  | 0.0611  | 0.0496  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 83.00  | 17.60  | 5.34   | 5.63    | 1.77    | 0.73    |
| SAMPLE STD DEVIATION                                | 1.1594 | 0.1266 | 0.0577 | 0.0327  | 0.0204  | 0.0159  |
| CUMULATIVE TEST TIME                                | 4.285  | 21.018 | 49.447 | 88.955  | 134.255 | 195.721 |
| CUMULATIVE FAILURES                                 | 3.0500 | 6.0200 | 8.8200 | 11.9500 | 14.5500 | 17.8000 |

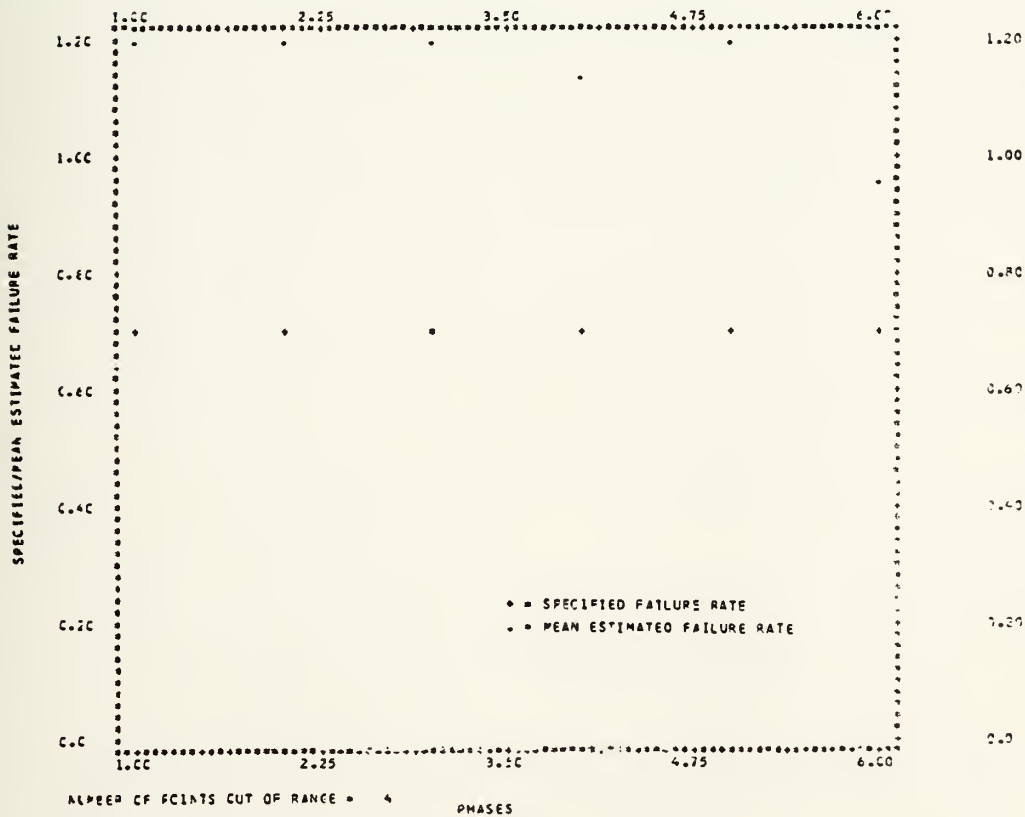




CASE B

5 ITEMS

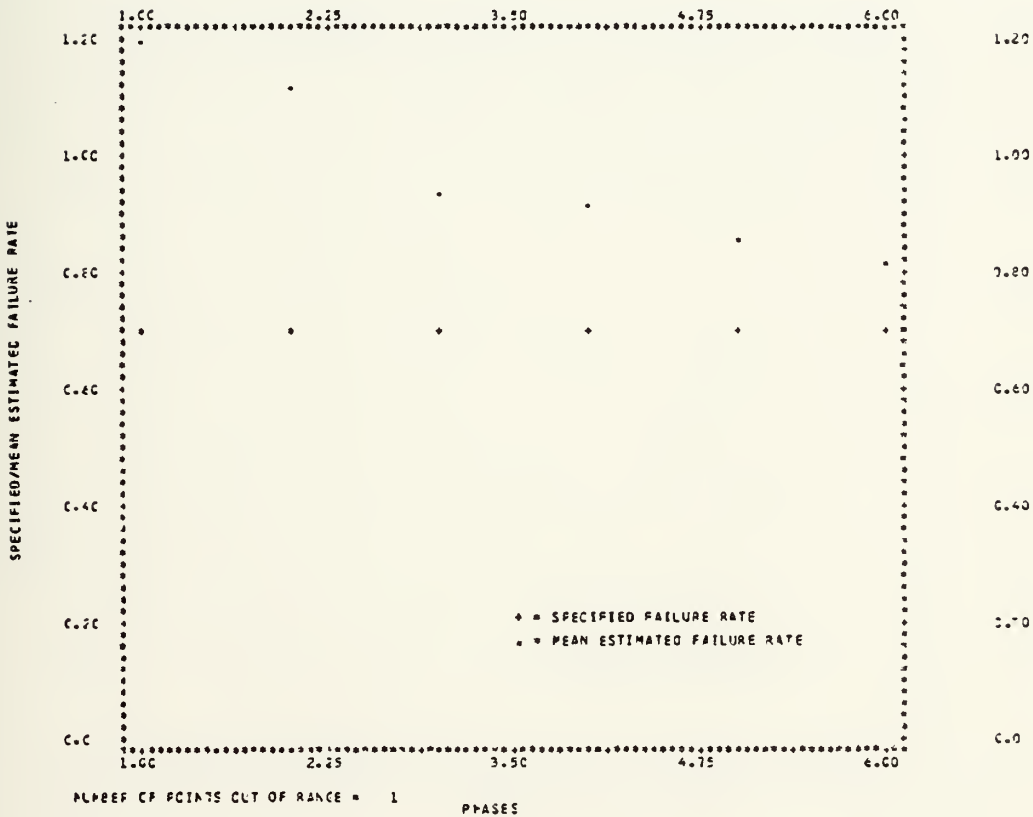
| PHASE  | 1       | 2       | 3      | 4      | 5      | 6      |
|--|---------|---------|--------|--------|--------|--------|
| ACTUAL FAILURE RATE                                      | 0.7000  | 0.7000  | 0.7000 | 0.7000 | 0.7000 | 0.7000 |
| PLANNED TEST TIME  | 0.2322  | 0.2322  | 0.2322 | 0.2322 | 0.2322 | 0.2322 |
| MODEL ESTIMATE   | 6.5483  | 6.2545  | 1.5116 | 1.1498 | 1.7859 | 0.9669 |
| ESTIMATE EFFICIENCY AS PERCENTAGE OF ACTUAL FAILURE RATE | 825.47  | 799.21  | 115.95 | 64.26  | 195.12 | 36.42  |
| SAMPLE STD DEVIATION                                     | 16.5964 | 36.6E78 | 1.5268 | 1.0363 | 7.2352 | 0.6603 |
| CUMULATIVE TEST TIME                                     | 1.075   | 2.154   | 3.221  | 4.309  | 5.385  | 6.442  |
| CUMULATIVE FAILURES                                      | 0.6000  | 1.4400  | 2.1600 | 2.8500 | 3.5700 | 4.4500 |







| PHASE   | 1      | 2      | 3      | 4      | 5      | 6      |
|---|--------|--------|--------|--------|--------|--------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.7000 | 0.7000 | 0.7000 | 0.7000 | 0.7000 |
| PLANNED TEST TIME                                   | 0.2322 | 0.2322 | 0.2322 | 0.2322 | 0.2322 | 0.2322 |
| MODEL ESTIMATE                                      | 1.9109 | 1.1103 | 0.9497 | 0.9227 | 0.8611 | 0.8247 |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 172.98 | 58.65  | 35.67  | 31.82  | 23.01  | 17.62  |
| SAMPLE STD DEVIATION                                | 2.2062 | 0.9809 | 0.6110 | 0.4208 | 0.4051 | 0.3530 |
| CUMULATIVE TEST TIME                                | 2.119  | 4.292  | 6.382  | 8.501  | 10.645 | 12.788 |
| CUMULATIVE FAILURES                                 | 1.6200 | 3.1100 | 4.7700 | 6.4300 | 7.8100 | 9.3500 |

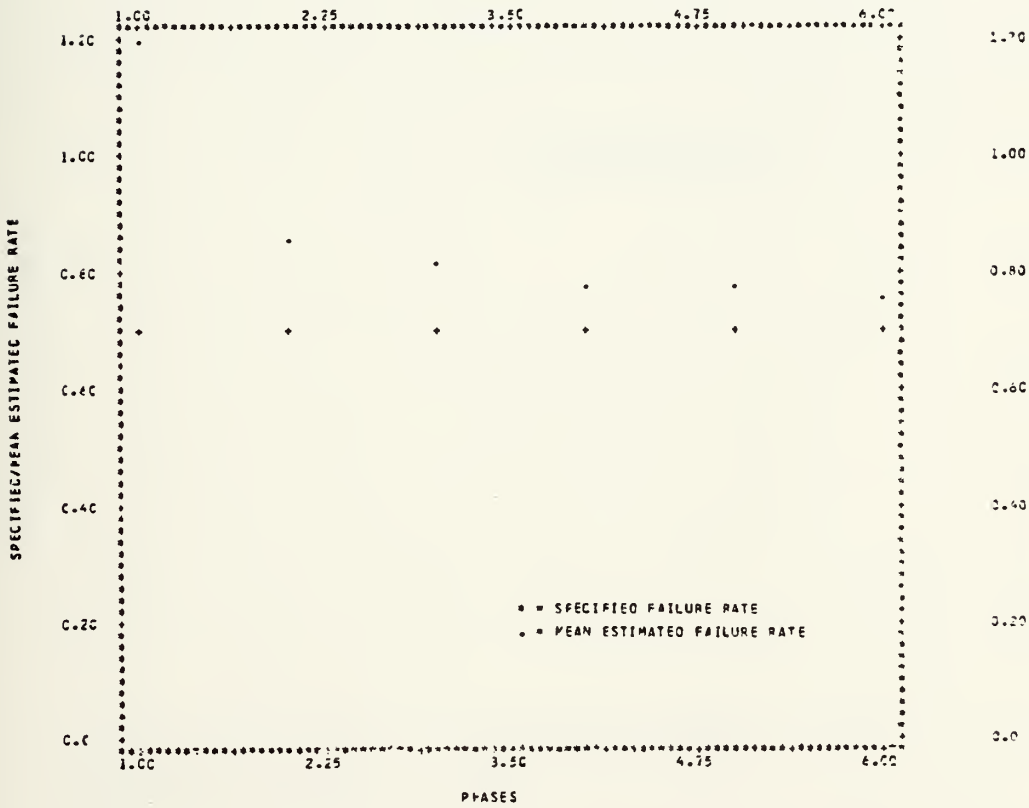




CASE 6

20 ITEMS

| PHASE   | 1      | 2      | 3      | 4       | 5       | 6       |
|---|--------|--------|--------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.7000 | 0.7000 | 0.7000  | 0.7000  | 0.7000  |
| PLANNED TEST TIME                                   | 0.2322 | 0.2322 | 0.2322 | 0.2322  | 0.2322  | 0.2322  |
| MODEL ESTIMATE                                      | 1.1974 | 0.8690 | 0.8298 | 0.7837  | 0.7802  | 0.7658  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 71.06  | 24.14  | 18.54  | 11.95   | 11.46   | 9.40    |
| SAMPLE STD DEVIATION                                | 1.0701 | 0.4662 | 0.3554 | 0.2971  | 0.2620  | 0.2302  |
| CUMULATIVE TEST TIME                                | 4.201  | 8.591  | 12.843 | 17.144  | 21.424  | 25.690  |
| CUMULATIVE FAILURES                                 | 2.9200 | 6.0000 | 9.2100 | 12.1900 | 15.2700 | 18.3200 |

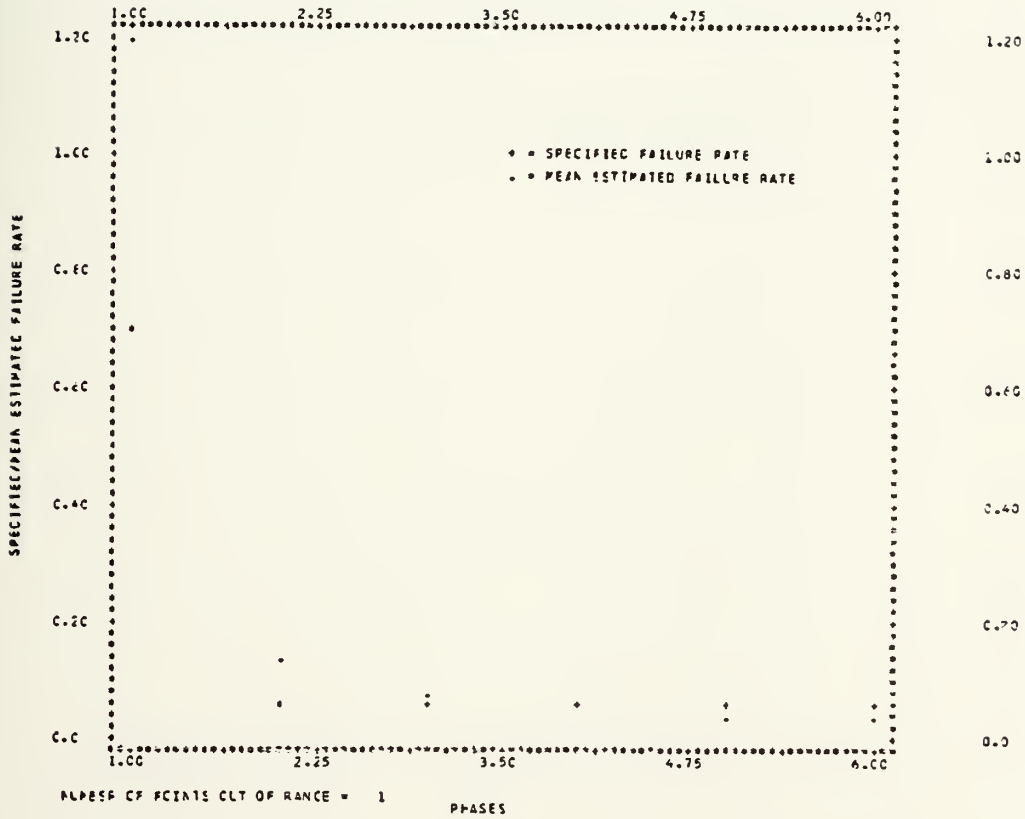




CASE 9

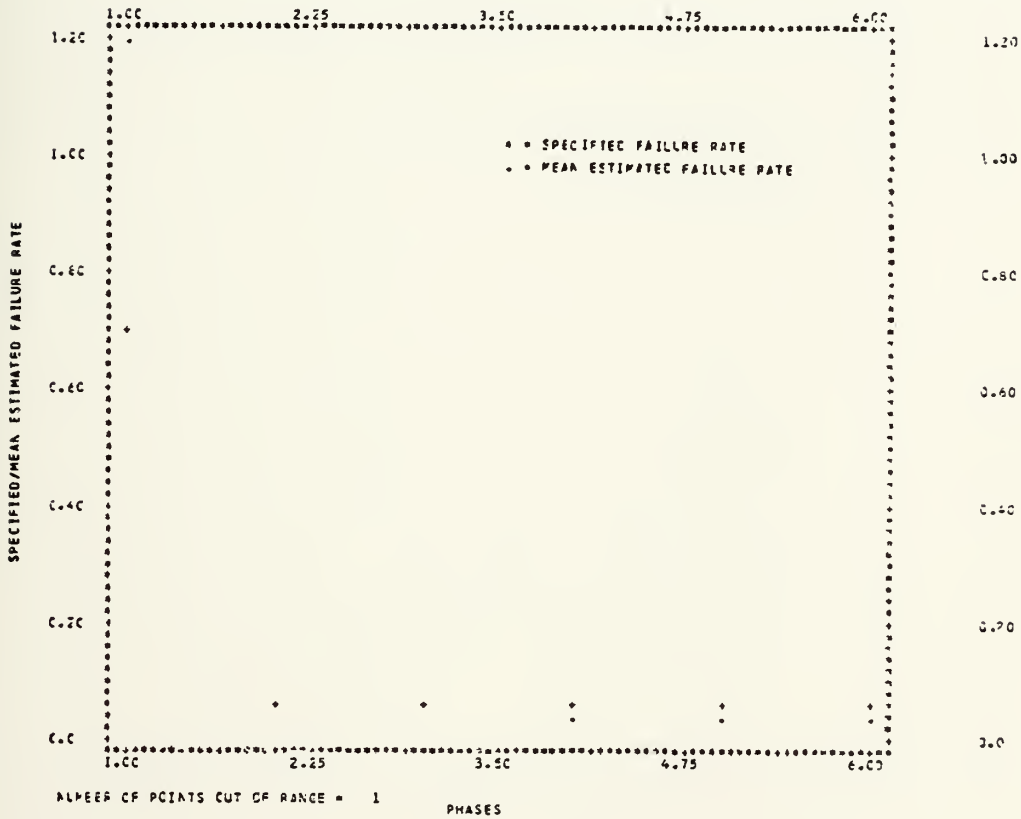
5 ITEMS

| PHASE   | 1      | 2      | 3      | 4      | 5      | 6      |
|---|--------|--------|--------|--------|--------|--------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.0500 | 0.0500 | 0.0500 | 0.0500 | 0.0500 |
| PLANNED TEST TIME                                   | 0.2322 | 3.2504 | 3.2504 | 3.2504 | 3.2504 | 3.2504 |
| MODEL ESTIMATE                                      | 3.0001 | 0.1346 | 0.0813 | 0.0563 | 0.0493 | 0.0484 |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 328.59 | 169.20 | 62.64  | 13.65  | 2.04   | 2.25   |
| SAMPLE STD DEVIATION                                | 3.3772 | 0.4560 | 0.0623 | 0.0539 | 0.0358 | 0.0297 |
| CUMULATIVE TEST TIME                                | 1.066  | 16.044 | 30.716 | 45.800 | 60.898 | 75.356 |
| CUMULATIVE FAILURES                                 | 0.7100 | 1.9100 | 2.4700 | 3.1300 | 3.8400 | 4.6400 |





| PHASE   | 1      | 2      | 3      | 4      | 5      | 6       |
|---|--------|--------|--------|--------|--------|---------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.0500 | 0.0500 | 0.0500 | 0.0500 | 0.0500  |
| PLANNED TEST TIME                                   | 0.2322 | 3.2504 | 3.2504 | 3.2504 | 3.2504 | 3.2504  |
| MODEL ESTIMATE                                      | 1.2220 | 0.0512 | 0.0506 | 0.0392 | 0.0418 | 0.0425  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 74.57  | 2.43   | 1.22   | 21.69  | 16.43  | 15.07   |
| SAMPLE STD DEVIATION                                | 1.0980 | 0.0601 | 0.1253 | 0.0227 | 0.0230 | 0.0245  |
| CUMULATIVE TEST TIME                                | 2.139  | 32.763 | 62.384 | 52.021 | 21.829 | 121.768 |
| CUMULATIVE FAILURES                                 | 1.4700 | 2.8500 | 4.3600 | 5.9600 | 7.6500 | 9.1500  |



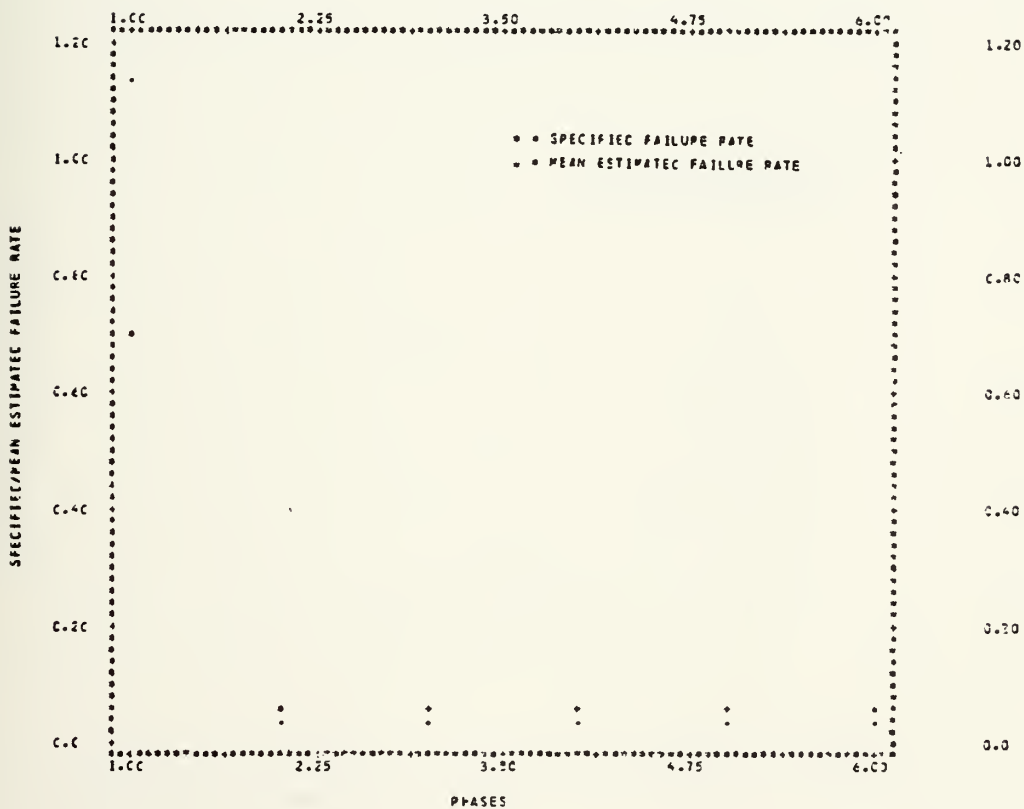




CASE 9

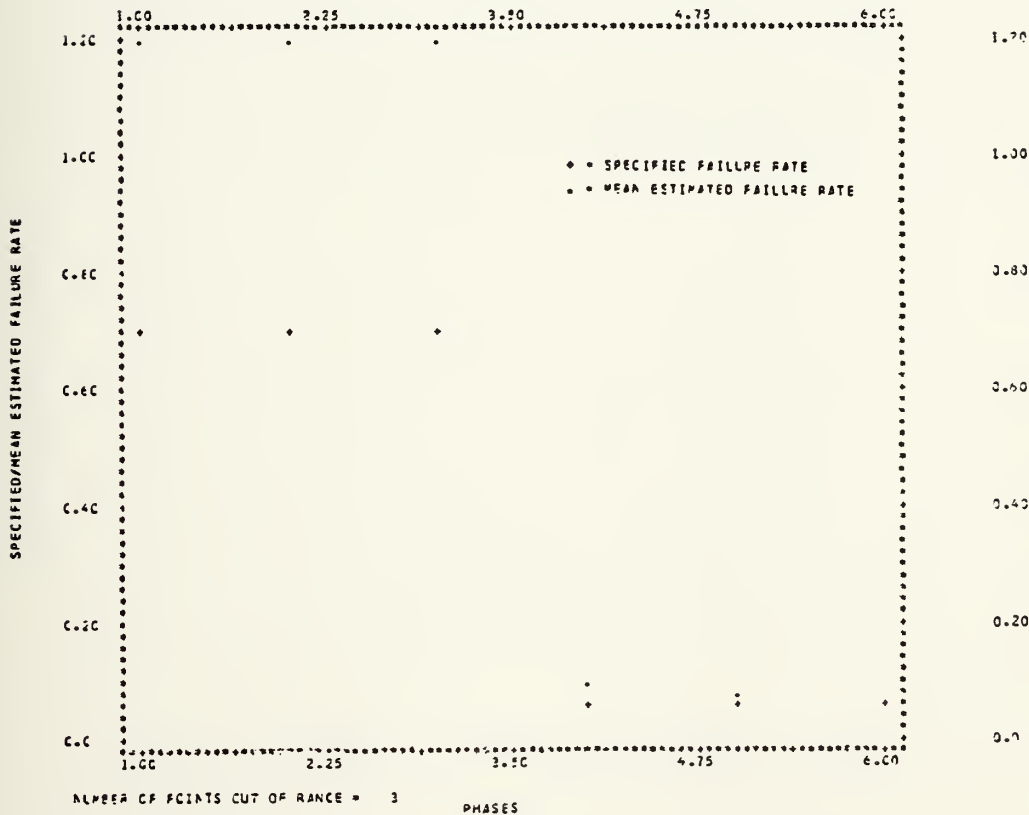
20 ITEMS

| PHASE   | 1      | 2      | 3       | 4       | 5       | 6       |
|---|--------|--------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.0500 | 0.0500  | 0.0500  | 0.0500  | 0.0500  |
| PLANNED TEST TIME                                   | 0.2322 | 3.2504 | 3.2504  | 3.2504  | 3.2504  | 3.2504  |
| MODEL ESTIMATE                                      | 1.1359 | 0.0449 | 0.0378  | 0.0392  | 0.0375  | 0.0368  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 62.27  | 10.11  | 26.46   | 21.63   | 24.94   | 22.44   |
| SAMPLE STD DEVIATION                                | 1.1273 | 0.0238 | 0.0163  | 0.0211  | 0.0144  | 0.0132  |
| CUMULATIVE TEST TIME                                | 4.308  | 64.787 | 124.366 | 164.253 | 244.683 | 304.580 |
| CUMULATIVE FAILURES                                 | 2.8000 | 5.5400 | 8.5600  | 11.6400 | 14.5200 | 17.6500 |





| PHASE   | 1      | 2      | 3      | 4      | 5      | 6      |
|---|--------|--------|--------|--------|--------|--------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.7000 | 0.7000 | 0.0500 | 0.0500 | 0.7500 |
| PLANNED TEST TIME                                   | 0.2322 | 0.2322 | 0.2322 | 3.2504 | 3.2504 | 3.2504 |
| MODEL ESTIMATE                                      | 3.1601 | 1.9107 | 1.4548 | 0.1021 | 0.0805 | 0.0577 |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 351.44 | 172.96 | 107.82 | 104.23 | 60.92  | 15.47  |
| SAMPLE STD DEVIATION                                | 4.1693 | 1.8739 | 1.6556 | 0.0706 | 0.0783 | 0.0370 |
| CUMULATIVE TEST TIME                                | 1.078  | 2.144  | 3.226  | 18.175 | 22.837 | 47.633 |
| CUMULATIVE FAILURES                                 | 0.0000 | 1.4500 | 2.0800 | 2.9500 | 3.8900 | 4.6400 |

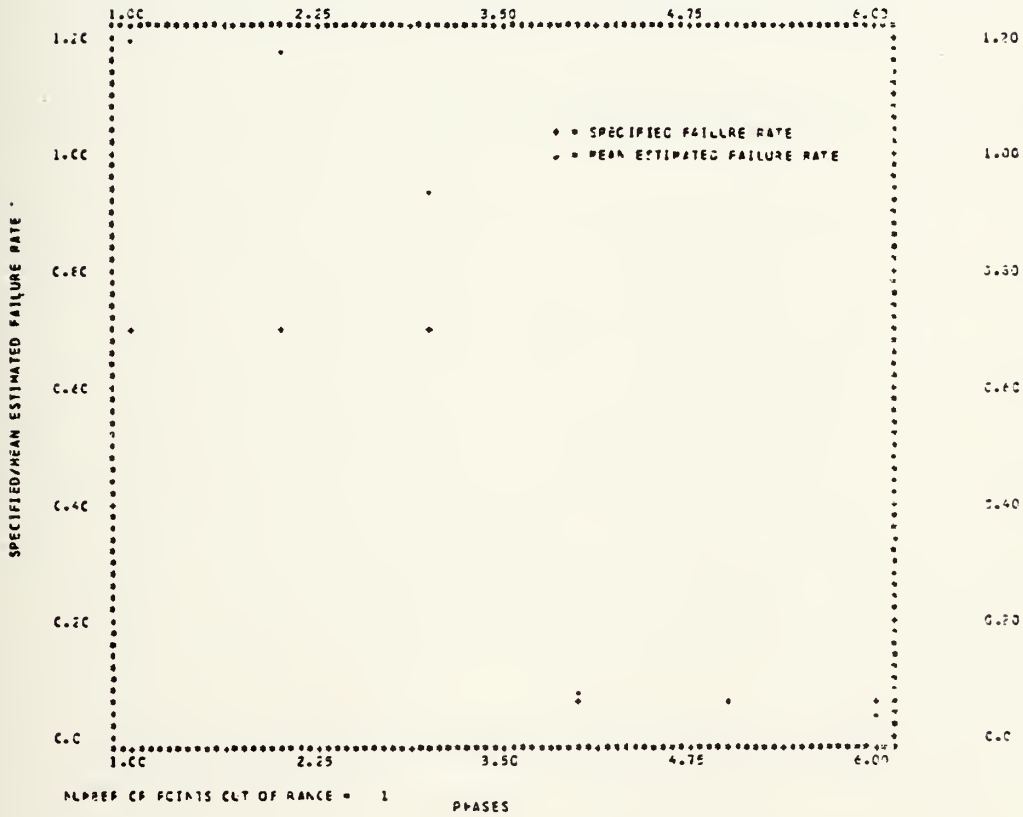




CASE 10

10 ITEMS

| PHASE   | 1       | 2      | 3      | 4      | 5      | 6      |
|---|---------|--------|--------|--------|--------|--------|
| ACTUAL FAILURE RATE                                 | 0.7000  | 0.7000 | 0.7000 | 0.0500 | 0.0500 | 0.0500 |
| PLANNED TEST TIME                                   | 0.2322  | 0.2322 | 0.2322 | 3.2504 | 3.2504 | 3.2504 |
| MCDL ESTIMATE                                       | 17.6544 | 1.1667 | 0.9306 | 0.0861 | 0.0537 | 0.0455 |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 2422.05 | 65.81  | 32.94  | 72.14  | 7.43   | 8.50   |
| SAMPLE STD DEVIATION                                | *****   | 1.0254 | 0.0256 | 0.0461 | 0.0234 | 0.0186 |
| CUMULATIVE TEST TIME                                | 2.134   | 4.277  | 6.418  | 36.130 | 66.232 | 96.210 |
| CUMULATIVE FAILURES                                 | 1.5200  | 3.0200 | 4.5200 | 6.1400 | 7.5800 | 9.1300 |

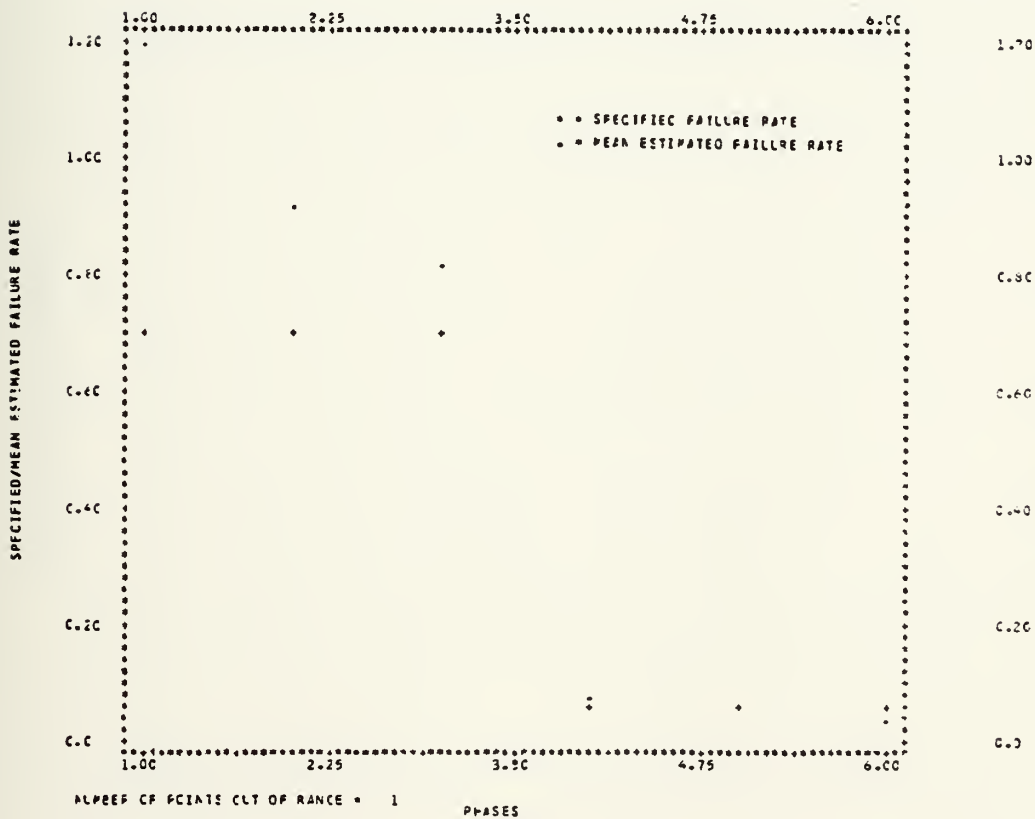




CASE 10

20 ITEMS

| PHASE   | 1      | 2      | 3      | 4       | 5       | 6       |
|---|--------|--------|--------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.7000 | 0.7000 | 0.0500  | 0.0500  | 0.0500  |
| PLANNED TEST TIME                                   | 0.2322 | 0.2322 | 0.2322 | 3.2504  | 3.7504  | 3.7504  |
| MODEL ESTIMATE                                      | 1.2568 | 0.9132 | 0.8192 | 0.0769  | 0.0503  | 0.0423  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 79.54  | 59.40  | 17.03  | 53.71   | 0.66    | 19.47   |
| SAMPLE STD DEVIATION                                | 1.1601 | 0.5346 | 0.4100 | 0.0267  | 0.0174  | 0.0129  |
| CUMULATIVE TEST TIME                                | 4.250  | 8.535  | 12.825 | 72.919  | 133.373 | 193.287 |
| CUMULATIVE FAILURES                                 | 3.1500 | 6.3100 | 9.2700 | 12.0300 | 15.0500 | 18.0600 |



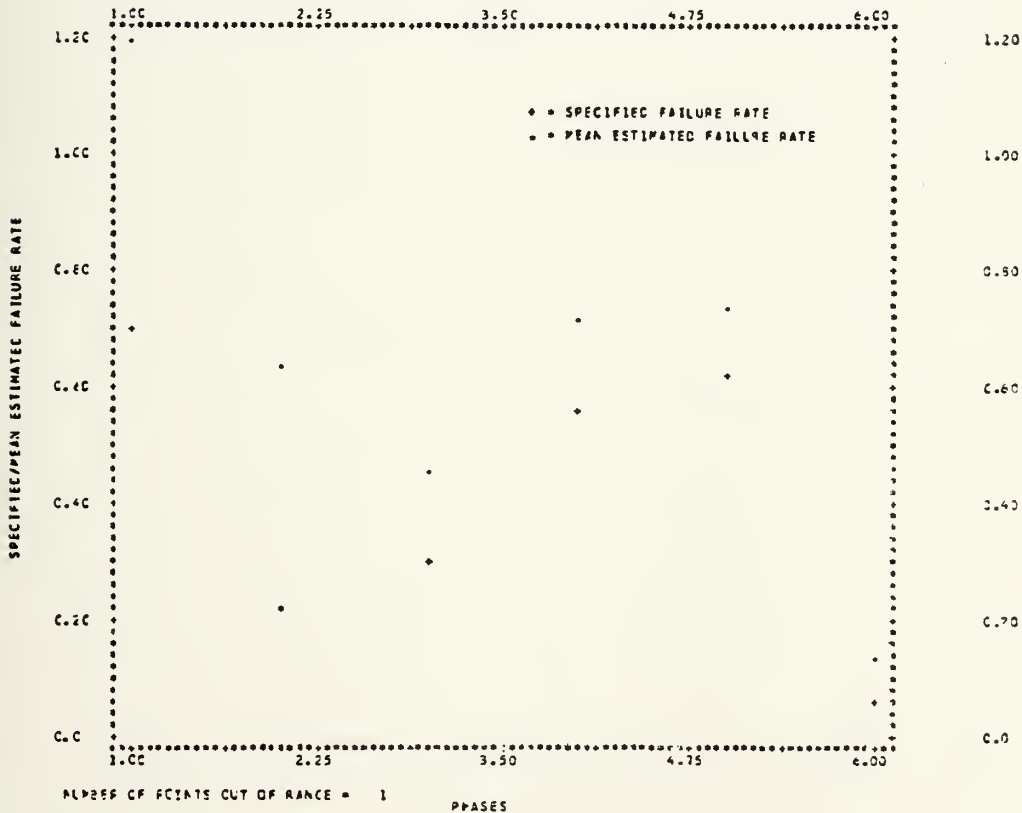




CASE 11

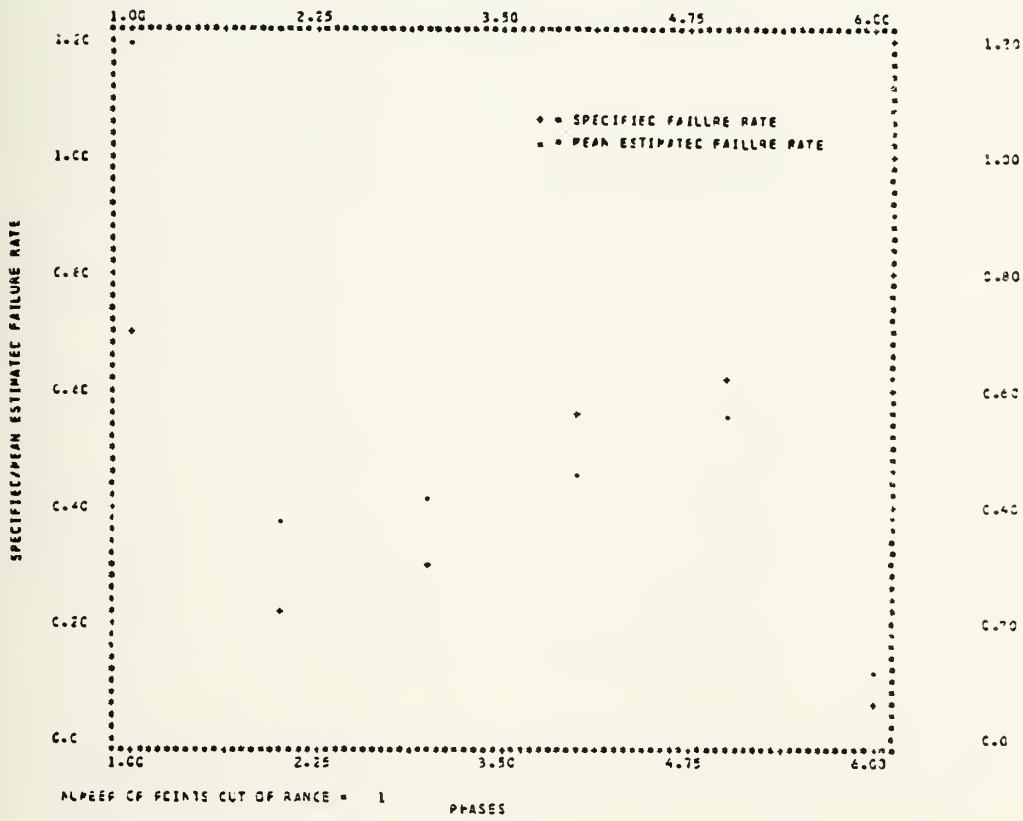
5.17EPC

| PHASE   | 1      | 2      | 3      | 4      | 5      | 6      |
|---|--------|--------|--------|--------|--------|--------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.2250 | 0.3000 | 0.5500 | 0.6100 | 0.0500 |
| PLANNED TEST TIME                                   | 0.2322 | 0.7223 | 0.5417 | 0.2955 | 0.2664 | 3.2504 |
| MODEL ESTIMATE                                      | 2.1895 | 0.6307 | 0.4601 | 0.7153 | 0.7336 | 0.1368 |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 212.79 | 180.33 | 53.38  | 30.06  | 20.24  | 173.57 |
| SAMPLE STD DEVIATION                                | 2.3593 | 0.7266 | 0.3905 | 0.8522 | 0.6498 | 0.0861 |
| CUMULATIVE TEST TIME                                | 1.061  | 4.334  | 6.850  | 8.174  | 9.398  | 24.311 |
| CUMULATIVE FAILURES                                 | 0.6400 | 1.6000 | 2.3200 | 3.2300 | 4.0400 | 4.8200 |





| PHASE   | 1      | 2      | 3      | 4      | 5      | 6      |
|---|--------|--------|--------|--------|--------|--------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.2250 | 0.3000 | 0.5500 | 0.6100 | 0.0500 |
| PLANNED TEST TIME                                   | 0.2322 | 0.7223 | 0.5417 | 0.2955 | 0.2664 | 3.2504 |
| MODEL ESTIMATE                                      | 1.5355 | 0.3774 | 0.4103 | 0.4614 | 0.5680 | 0.1256 |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 119.36 | 67.73  | 36.78  | 16.11  | 6.88   | 151.23 |
| SAMPLE STD DEVIATION                                | 1.8078 | 0.3559 | 0.5967 | 0.3514 | 0.3702 | 0.0536 |
| CUMULATIVE TEST TIME                                | 2.152  | 8.799  | 13.780 | 16.489 | 18.896 | 48.642 |
| CUMULATIVE FAILURES                                 | 1.3800 | 2.9400 | 4.5200 | 6.1000 | 7.5500 | 9.4500 |

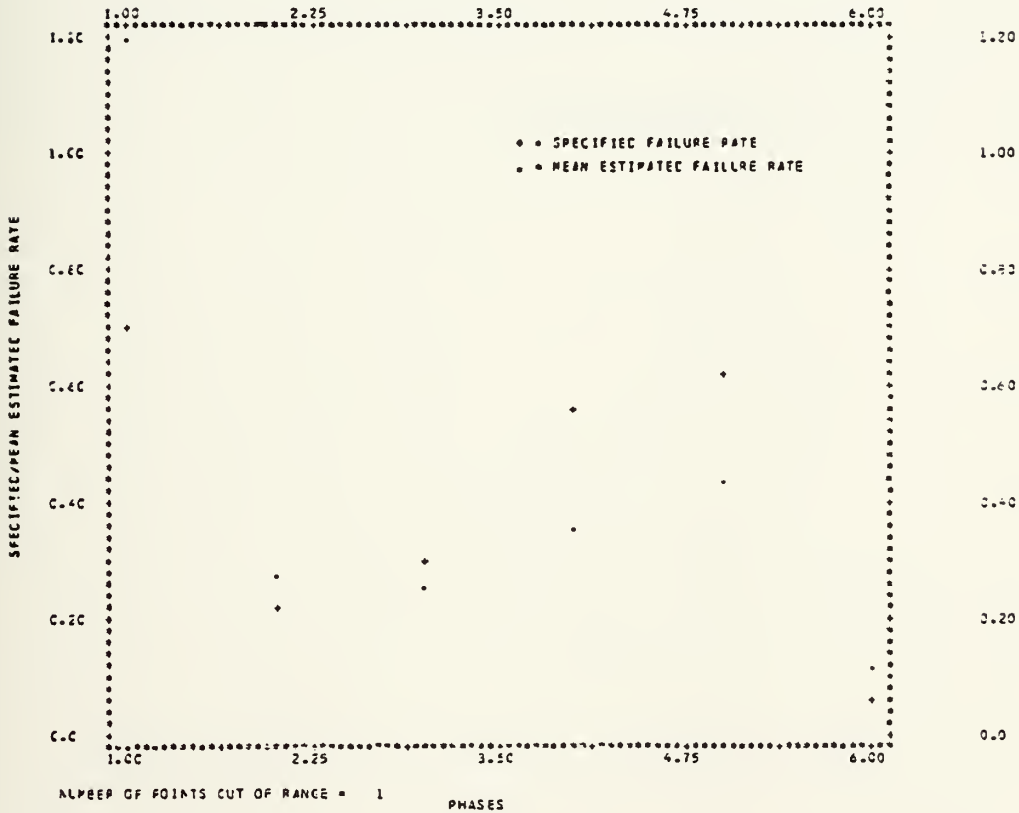




CASE 11

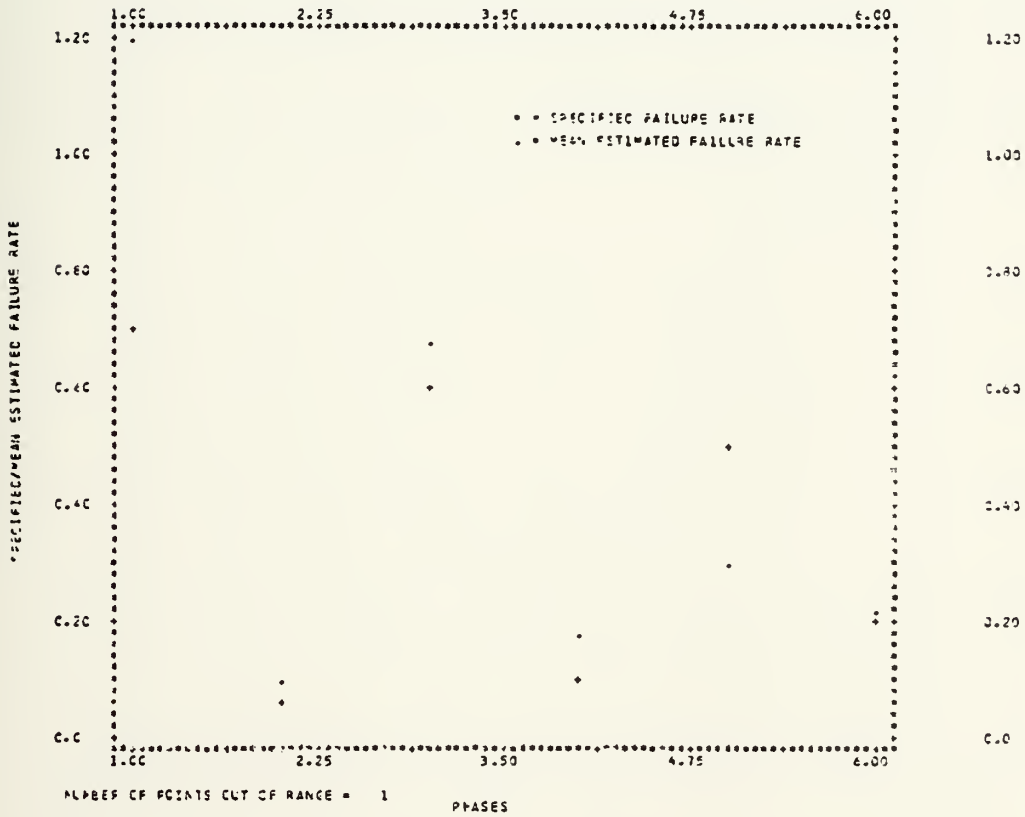
20 ITEMS

| PHASE   | 1      | 2      | 3      | 4       | 5       | 6       |
|---|--------|--------|--------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.2250 | 0.3000 | 0.5500  | 0.6100  | 0.0500  |
| PLANNED TEST TIME                                   | 0.2322 | 0.7223 | 0.5417 | 0.2955  | 0.2664  | 3.2504  |
| MODEL ESTIMATE                                      | 1.2623 | 0.2759 | 0.2641 | 0.3507  | 0.4363  | 0.1140  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 80.33  | 22.61  | 11.96  | 36.24   | 28.47   | 127.98  |
| SAMPLE STD DEVIATION                                | 1.1929 | 0.1555 | 0.1286 | 0.1534  | 0.1742  | 0.0371  |
| CUMULATIVE TEST TIME                                | 4.305  | 17.622 | 27.723 | 33.145  | 38.013  | 97.892  |
| CUMULATIVE FAILURES                                 | 2.9500 | 5.9500 | 8.8200 | 11.9700 | 15.3400 | 18.3400 |





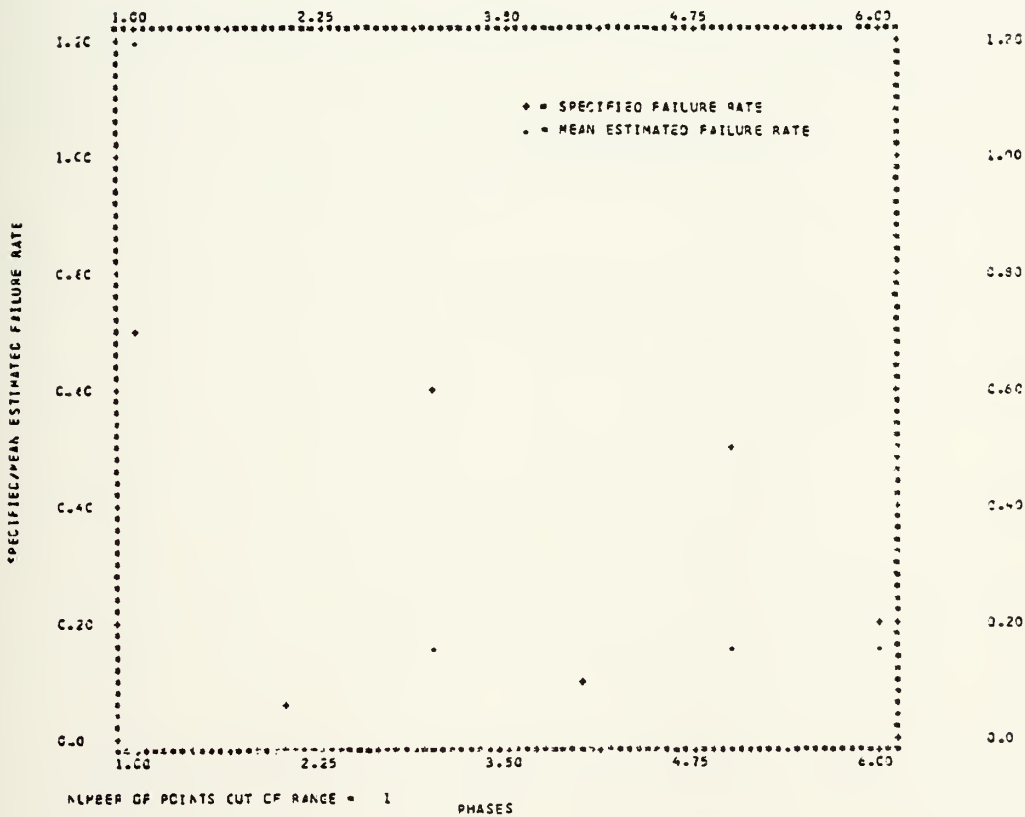
| PHASE   | 1      | 2      | 3      | 4      | 5      | 6      |
|---|--------|--------|--------|--------|--------|--------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.0500 | 0.6000 | 0.1000 | 0.5000 | 0.2000 |
| PLANNED TEST TIME                                   | 0.2222 | 3.2204 | 0.2709 | 1.6252 | 0.3250 | 0.8126 |
| MODEL ESTIMATE                                      | 2.6735 | 0.1042 | 0.6812 | 0.1809 | 0.3008 | 0.2121 |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 281.93 | 108.45 | 13.54  | 80.87  | 39.29  | 6.04   |
| SAMPLE STD DEVIATION                                | 4.1245 | 0.1813 | 1.5503 | 0.1921 | 0.5044 | 0.1926 |
| CUMULATIVE TEST TIME                                | 1.071  | 15.554 | 17.191 | 24.740 | 26.225 | 30.031 |
| CUMULATIVE FAILURES                                 | 0.6300 | 1.4600 | 2.3600 | 3.1000 | 3.8700 | 4.4700 |





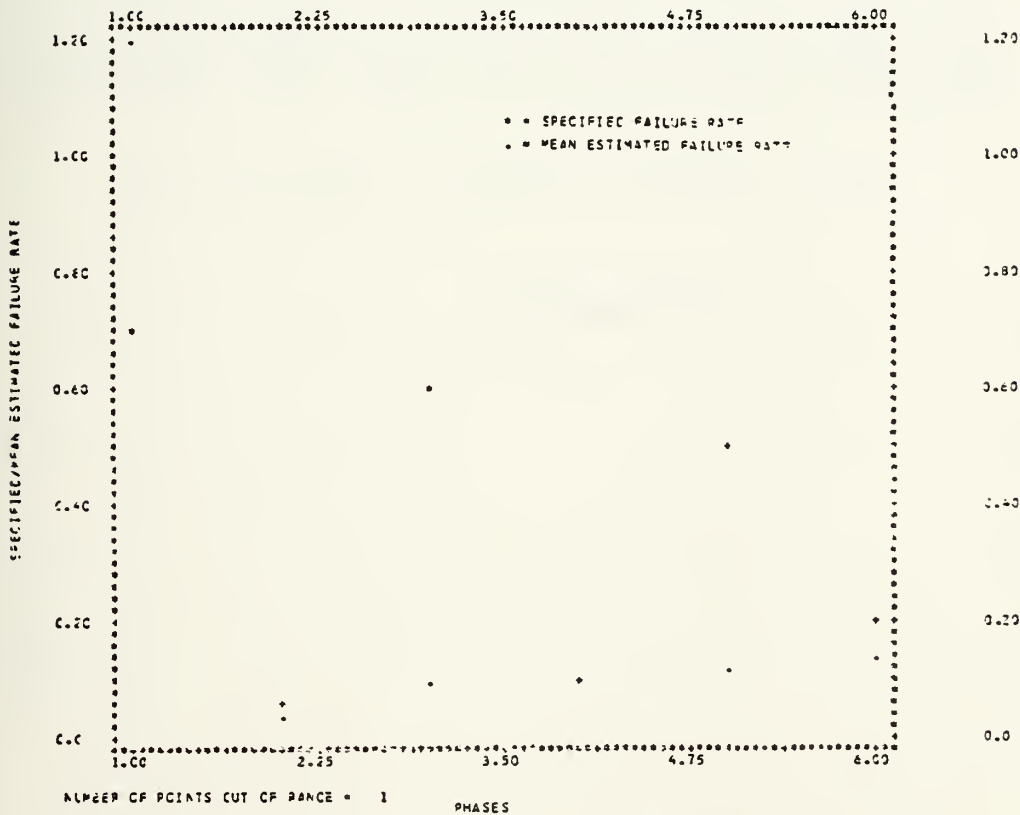


| PHASE   | 1       | 2      | 3      | 4      | 5      | 6      |
|---|---------|--------|--------|--------|--------|--------|
| ACTUAL FAILURE RATE                                 | 0.7000  | 0.0500 | 0.6000 | 0.1000 | 0.5000 | 0.2000 |
| PLANNED TEST TIME                                   | 0.2322  | 3.2504 | 0.2709 | 1.6252 | 0.3210 | 0.8126 |
| WCEL ESTIMATE                                       | 4.7415  | 0.0632 | 0.1653 | 0.1080 | 0.1536 | 0.1602 |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 577.36  | 26.50  | 72.46  | 8.01   | 69.28  | 19.92  |
| SAMPLE STD DEVIATION                                | 24.3199 | 0.0610 | 0.2669 | 0.0750 | 0.1179 | 0.1070 |
| CUMULATIVE TEST TIME                                | 2.130   | 32.160 | 34.663 | 49.818 | 52.822 | 60.420 |
| CUMULATIVE FAILURES                                 | 1.4300  | 2.9300 | 4.4600 | 5.8600 | 7.3600 | 8.7000 |





| PHASE   | 1      | 2      | 3      | 4       | 5       | 6       |
|---|--------|--------|--------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.0500 | 0.6000 | 0.1000  | 0.5000  | 0.2000  |
| PLANNED TEST TIME                                   | 0.2322 | 3.2504 | 0.2709 | 1.6252  | 0.3250  | 0.8126  |
| MCCEL ESTIMATE                                      | 1.3544 | 0.0467 | 0.0941 | 0.0913  | 0.1258  | 0.1419  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 93.49  | 6.63   | 84.31  | 8.74    | 74.33   | 29.03   |
| SAMPLE STD DEVIATION                                | 1.5688 | 0.0256 | 0.0513 | 0.0426  | 0.0535  | 0.0610  |
| CUMULATIVE TEST TIME                                | 4.248  | 64.425 | 69.629 | 99.672  | 105.672 | 120.636 |
| CUMULATIVE FAILURES                                 | 3.2700 | 6.1100 | 9.0400 | 12.1300 | 15.0400 | 18.0700 |



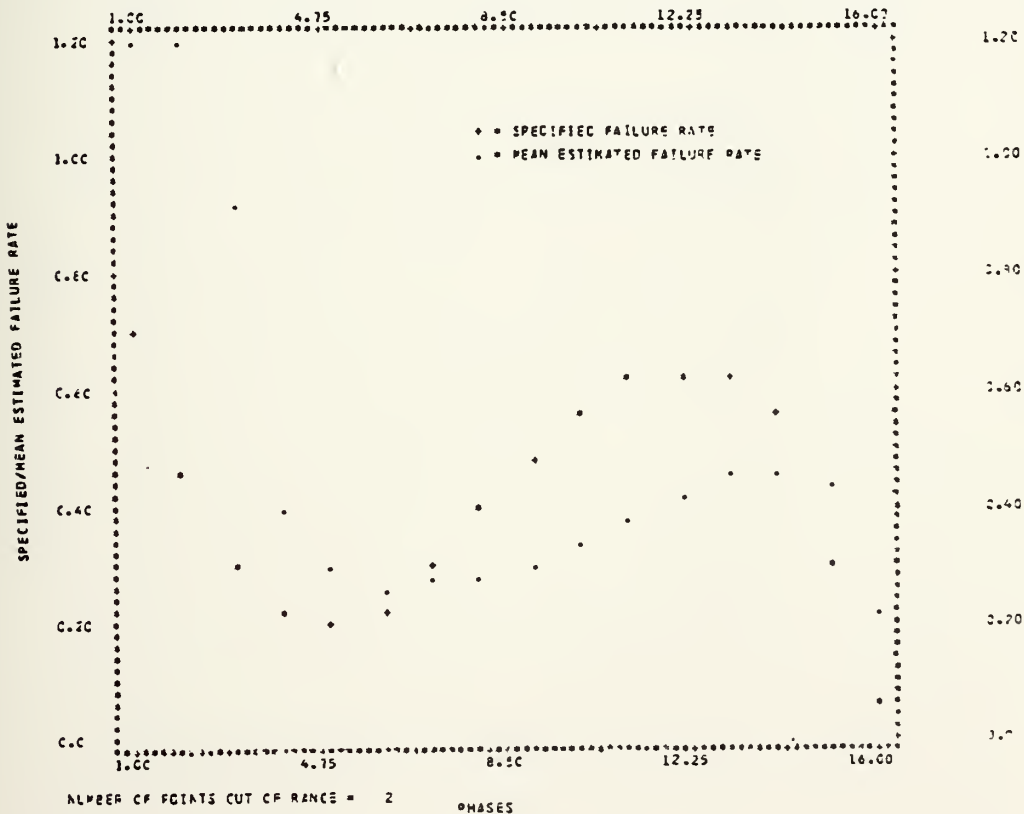


CASE 13

5 STEPS

| PHASE   | 1      | 2      | 3      | 4      | 5      | 6      | 7      | 8      |
|---|--------|--------|--------|--------|--------|--------|--------|--------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.4500 | 0.3000 | 0.2250 | 0.2000 | 0.2250 | 0.3000 | 0.4000 |
| PLANNED TEST TIME                                   | 0.2322 | 0.3612 | 0.5417 | 0.7223 | 0.8126 | 0.7223 | 0.5417 | 0.4000 |
| MODEL ESTIMATE                                      | 2.1655 | 1.2515 | 0.9266 | 0.4025 | 0.3071 | 0.2629 | 0.2761 | 0.2789 |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 209.36 | 187.10 | 208.88 | 78.89  | 52.55  | 16.83  | 7.58   | 30.26  |
| SAMPLE STD DEVIATION                                | 1.7129 | 1.2175 | 2.3761 | 0.3381 | 0.7777 | 0.1625 | 0.1523 | 0.1635 |
| CUMULATIVE TEST TIME                                | 1.0384 | 2.741  | 5.213  | 8.521  | 17.284 | 19.637 | 18.138 | 20.056 |
| CUMULATIVE FAILURES                                 | 0.5500 | 1.4300 | 2.2100 | 3.0500 | 3.7900 | 4.5000 | 5.2000 | 5.8700 |

| PHASE   | 9      | 10     | 11     | 12     | 13     | 14      | 15      | 16      |
|---|--------|--------|--------|--------|--------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.4750 | 0.5000 | 0.6100 | 0.6250 | 0.6100 | 0.5500  | 0.3000  | 0.0500  |
| PLANNED TEST TIME                                   | 0.3421 | 0.2655 | 0.2664 | 0.2600 | 0.2664 | 0.2959  | 0.5417  | 3.7374  |
| MODEL ESTIMATE                                      | 0.2963 | 0.3387 | 0.3831 | 0.4242 | 0.4534 | 0.4689  | 0.4767  | 0.2276  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 37.62  | 38.42  | 37.20  | 32.12  | 24.85  | 14.75   | 45.57   | 345.21  |
| SAMPLE STD DEVIATION                                | 0.1803 | 0.2024 | 0.2230 | 0.2458 | 0.3160 | 0.2342  | 0.2118  | 0.0939  |
| CUMULATIVE TEST TIME                                | 21.655 | 23.016 | 24.225 | 25.423 | 26.636 | 27.956  | 30.517  | 45.579  |
| CUMULATIVE FAILURES                                 | 6.4700 | 7.3000 | 8.1400 | 8.9600 | 9.7800 | 10.6100 | 11.3100 | 12.1000 |



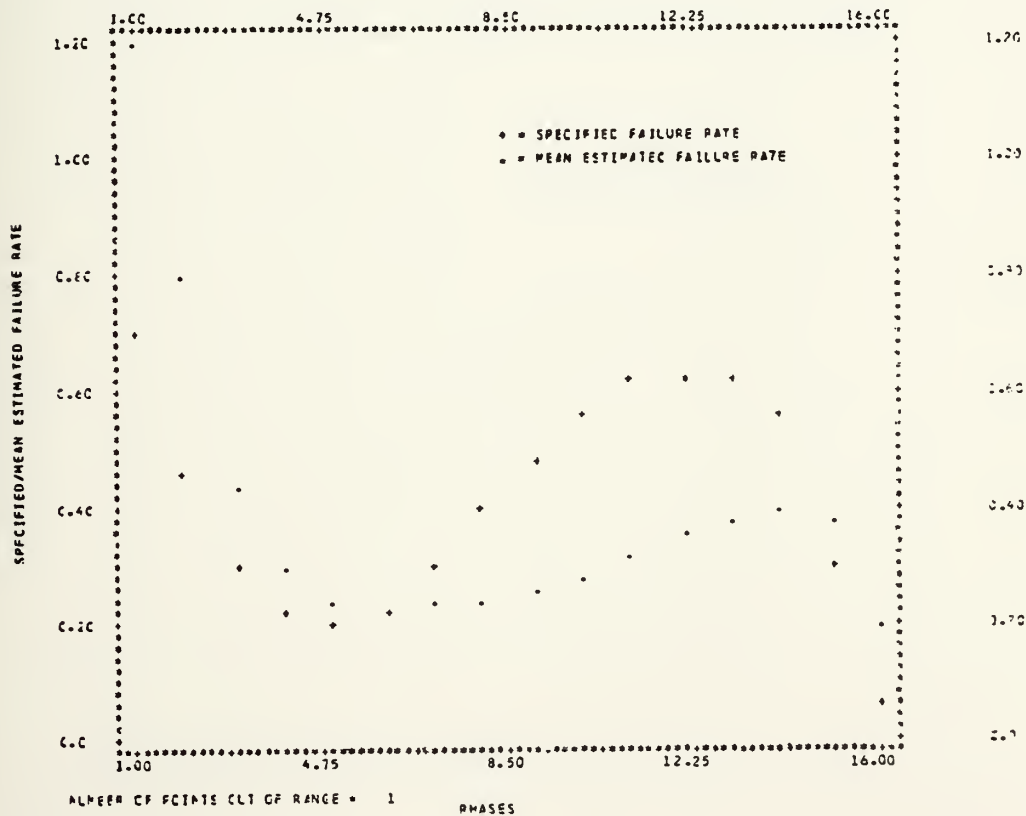


CASE 13

10 ITEMS

| PHASE   | 1      | 2      | 3      | 4      | 5      | 6      | 7       | 8       |
|---|--------|--------|--------|--------|--------|--------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.4500 | 0.3000 | 0.2250 | 0.2000 | 0.2250 | 0.3700  | 0.4000  |
| PLANNED TEST TIME                                   | 0.2322 | 0.3612 | 0.5417 | 0.7223 | 0.8126 | 0.7223 | 0.5417  | 0.4063  |
| MODEL ESTIMATE                                      | 2.0712 | 0.3055 | 0.4461 | 0.3011 | 0.2488 | 0.2260 | 0.2335  | 0.2442  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 195.65 | 79.00  | 48.71  | 33.84  | 24.39  | 0.45   | 22.15   | 38.95   |
| SAMPLE STD DEVIATION                                | 2.4201 | 0.9641 | 0.3452 | 0.1538 | 0.1089 | 0.0566 | 0.1015  | 0.0543  |
| CUMULATIVE TEST TIME                                | 2.114  | 5.466  | 10.457 | 17.116 | 24.621 | 31.344 | 36.371  | 40.172  |
| CUMULATIVE FAILURES                                 | 1.5000 | 3.2400 | 4.6000 | 6.1800 | 7.7900 | 9.1100 | 10.4900 | 11.7900 |

| PHASE   | 9       | 10      | 11      | 12      | 13      | 14      | 15      | 16      |
|---|---------|---------|---------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.4750  | 0.5500  | 0.6100  | 0.6250  | 0.6100  | 0.5500  | 0.3700  | 0.0500  |
| PLANNED TEST TIME                                   | 0.3421  | 0.2955  | 0.2664  | 0.2600  | 0.2664  | 0.2955  | 0.5417  | 3.7574  |
| MODEL ESTIMATE                                      | 0.2631  | 0.2833  | 0.3187  | 0.3502  | 0.3770  | 0.3565  | 0.3986  | 0.1999  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 44.61   | 48.49   | 47.75   | 43.97   | 38.20   | 27.55   | 29.52   | 256.61  |
| SAMPLE STD DEVIATION                                | 0.1144  | 0.1052  | 0.1199  | 0.1297  | 0.1384  | 0.1498  | 0.1446  | 0.0566  |
| CUMULATIVE TEST TIME                                | 43.361  | 46.123  | 48.581  | 50.967  | 53.426  | 56.146  | 61.066  | 91.349  |
| CUMULATIVE FAILURES                                 | 13.0500 | 14.3800 | 16.0100 | 17.6000 | 19.1400 | 20.6300 | 22.2300 | 23.5800 |

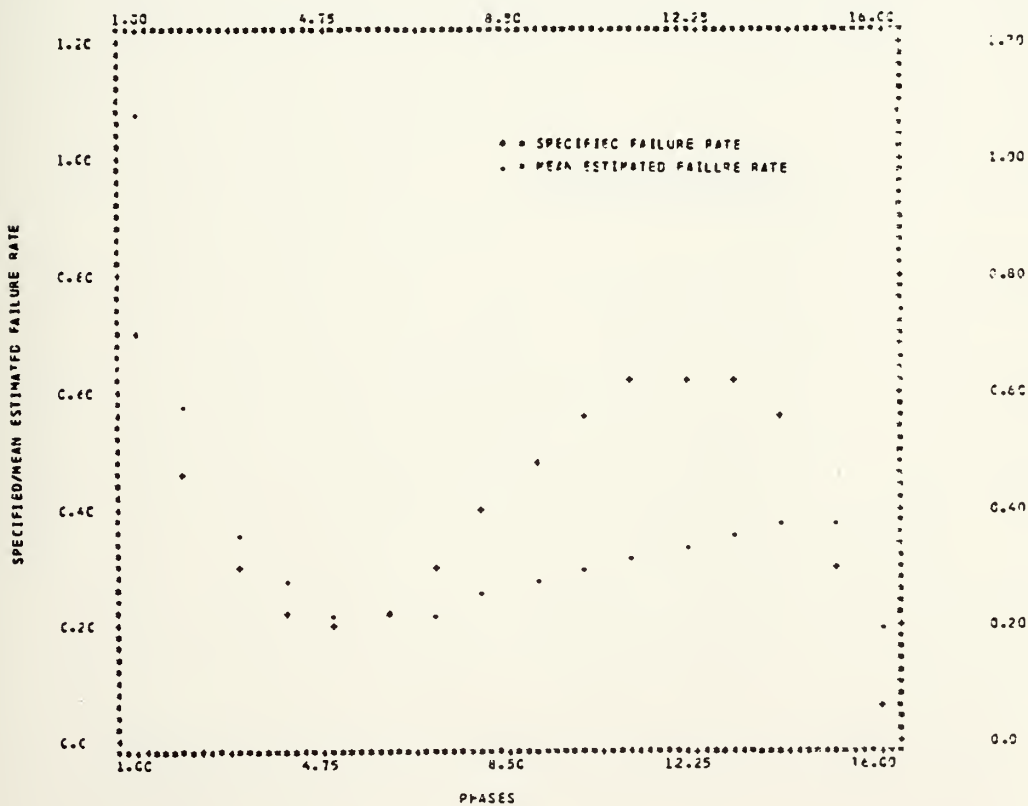






| PHASE   | 1      | 2      | 3      | 4       | 5       | 6       | 7       | 9       |
|---|--------|--------|--------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.4500 | 0.3000 | 0.2250  | 0.2000  | 0.2250  | 0.3300  | 0.4000  |
| PLANNED TEST TIME                                   | 0.2322 | 0.3612 | 0.5417 | 0.7223  | 0.8124  | 0.7223  | 0.5417  | 0.4000  |
| MODEL ESTIMATE                                      | 1.0814 | 0.5749 | 0.3574 | 0.2743  | 0.2243  | 0.2144  | 0.2286  | 0.2709  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 54.48  | 27.75  | 19.15  | 21.93   | 12.13   | 4.70    | 23.79   | 37.26   |
| SAMPLE STD DEVIATION                                | 0.3051 | 0.3507 | 0.1542 | 0.1061  | 0.0731  | 0.0767  | 0.0803  | 0.0810  |
| CUMULATIVE TEST TIME                                | 4.205  | 10.555 | 21.040 | 34.271  | 45.286  | 62.670  | 72.571  | 80.007  |
| CUMULATIVE FAILURES                                 | 3.0100 | 5.5500 | 8.8700 | 12.0200 | 15.0100 | 18.0000 | 21.1700 | 24.2300 |

| PHASE   | 9       | 10      | 11      | 12      | 13      | 14      | 15      | 16      |
|---|---------|---------|---------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.4750  | 0.5500  | 0.6100  | 0.6750  | 0.6100  | 0.5500  | 0.5000  | 0.4500  |
| PLANNED TEST TIME                                   | 0.3421  | 0.2555  | 0.2064  | 0.2000  | 0.2064  | 0.2555  | 0.3417  | 0.2504  |
| MODEL ESTIMATE                                      | 0.2736  | 0.2985  | 0.3251  | 0.3494  | 0.3697  | 0.3693  | 0.3794  | 0.2014  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 42.41   | 45.72   | 46.71   | 44.10   | 35.39   | 29.23   | 26.48   | 302.73  |
| SAMPLE STD DEVIATION                                | 0.0907  | 0.0885  | 0.0877  | 0.0921  | 0.0906  | 0.0874  | 0.0813  | 0.0387  |
| CUMULATIVE TEST TIME                                | 24.320  | 91.794  | 96.751  | 101.574 | 106.504 | 111.497 | 121.895 | 132.120 |
| CUMULATIVE FAILURES                                 | 27.1300 | 30.0000 | 33.0000 | 35.9700 | 36.8100 | 41.5000 | 45.1200 | 47.5500 |



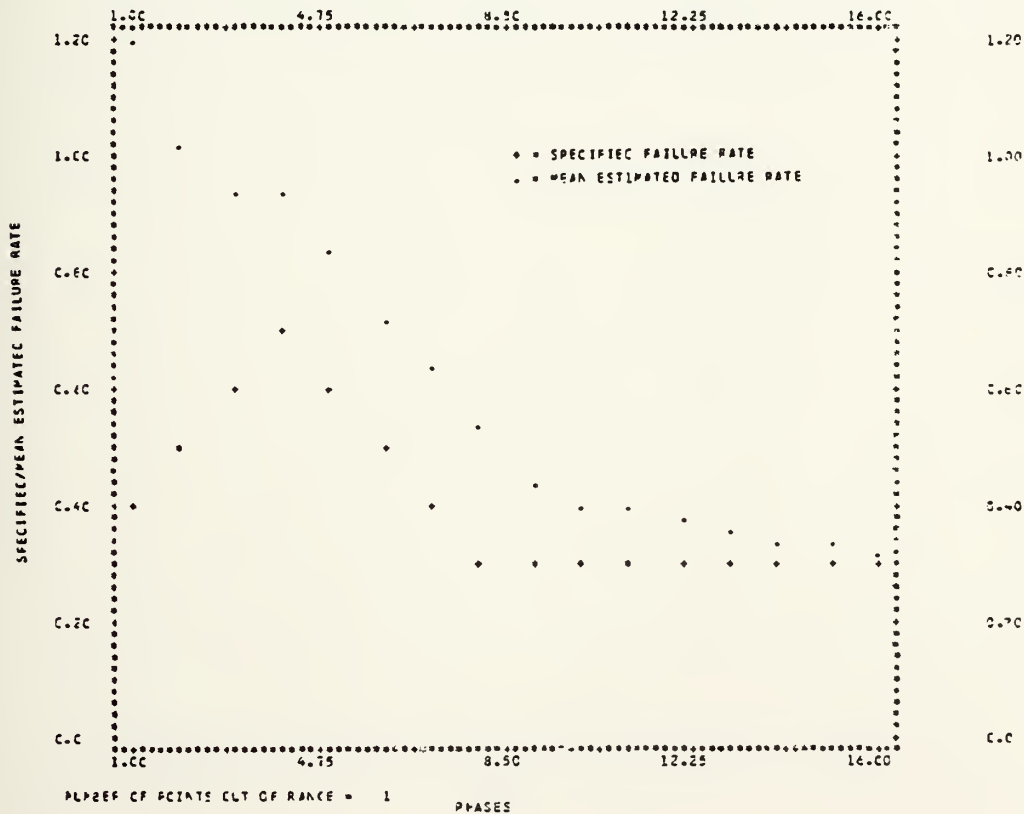


CASE 14

5 ITEMS

| PHASE   | 1      | 2      | 3      | 4      | 5      | 6      | 7      | 8      |
|---|--------|--------|--------|--------|--------|--------|--------|--------|
| ACTUAL FAILURE RATE                                 | 0.4000 | 0.5000 | 0.6000 | 0.7000 | 0.6000 | 0.5000 | 0.4000 | 0.3000 |
| PLANNED TEST TIME                                   | 0.4063 | 0.3250 | 0.2709 | 0.2322 | 0.2709 | 0.3250 | 0.4063 | 0.5417 |
| MODEL ESTIMATE                                      | 1.2017 | 1.0294 | 0.9462 | 0.9438 | 0.8370 | 0.7277 | 0.6429 | 0.5372 |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 200.44 | 105.83 | 57.71  | 34.83  | 39.50  | 45.54  | 60.72  | 79.05  |
| SAMPLE STD DEVIATION                                | 0.8653 | 1.0244 | 0.9428 | 0.8915 | 0.6107 | 0.4519 | 0.3990 | 0.3277 |
| CUMULATIVE TEST TIME                                | 1.901  | 3.419  | 4.675  | 5.754  | 7.016  | 8.322  | 10.302 | 12.875 |
| CUMULATIVE FAILURES                                 | 0.6300 | 1.0000 | 2.0700 | 2.8100 | 3.5400 | 4.2100 | 5.0100 | 5.6000 |

| PHASE   | 9      | 10     | 11     | 12     | 13     | 14      | 15      | 16      |
|---|--------|--------|--------|--------|--------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.3000 | 0.3000 | 0.3000 | 0.3000 | 0.3000 | 0.3000  | 0.3000  | 0.2000  |
| PLANNED TEST TIME                                   | 0.5417 | 0.5417 | 0.5417 | 0.5417 | 0.5417 | 0.5417  | 0.5417  | 0.5417  |
| MODEL ESTIMATE                                      | 0.4457 | 0.4034 | 0.3946 | 0.3751 | 0.3512 | 0.3369  | 0.3312  | 0.3197  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 48.56  | 34.47  | 31.52  | 25.00  | 17.00  | 12.30   | 10.40   | 6.57    |
| SAMPLE STD DEVIATION                                | 0.2358 | 0.2051 | 0.1958 | 0.1731 | 0.1414 | 0.1304  | 0.1289  | 0.1188  |
| CUMULATIVE TEST TIME                                | 15.418 | 17.919 | 20.576 | 22.857 | 25.381 | 27.685  | 30.394  | 32.911  |
| CUMULATIVE FAILURES                                 | 6.4400 | 7.1700 | 8.0500 | 8.8100 | 9.4600 | 10.1400 | 10.9100 | 11.5700 |



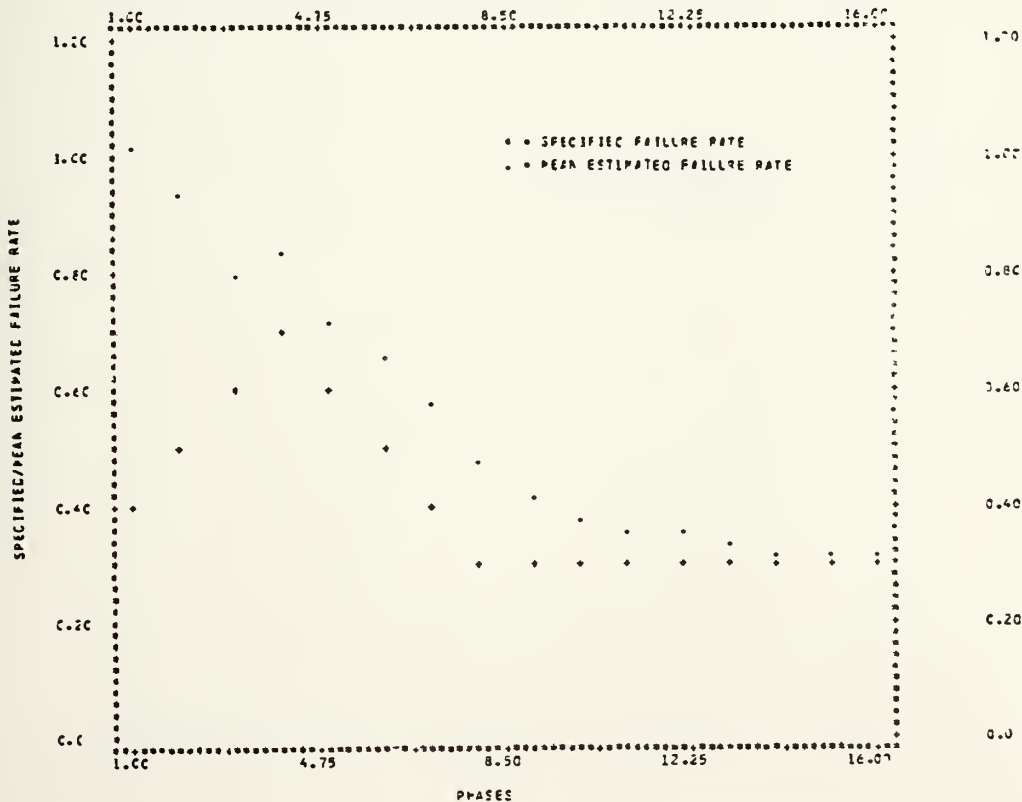


CASE 14

10 ITEMS

| PHASE   | 1      | 2      | 3      | 4      | 5      | 6      | 7       | 8       |
|---|--------|--------|--------|--------|--------|--------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.4000 | 0.5000 | 0.6000 | 0.7000 | 0.8000 | 0.9000 | 0.4000  | 0.3000  |
| PLANNED TEST TIME                                   | 0.4063 | 0.3750 | 0.2709 | 0.2322 | 0.3709 | 0.3290 | 0.4063  | 0.5417  |
| MODEL ESTIMATE                                      | 1.0249 | 0.9229 | 0.7954 | 0.8210 | 0.7100 | 0.6545 | 0.5741  | 0.4804  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 156.23 | 66.57  | 32.57  | 18.71  | 18.33  | 20.51  | 43.63   | 60.19   |
| SAMPLE STD DEVIATION                                | 1.1811 | 0.8713 | 0.4991 | 0.4529 | 0.3488 | 0.3173 | 0.2776  | 0.2097  |
| CUMULATIVE TEST TIME                                | 3.748  | 6.722  | 9.225  | 11.362 | 13.907 | 16.516 | 20.682  | 25.665  |
| CUMULATIVE FAILURES                                 | 1.5500 | 3.2700 | 4.7600 | 6.3500 | 7.5400 | 8.9600 | 10.4000 | 11.9200 |

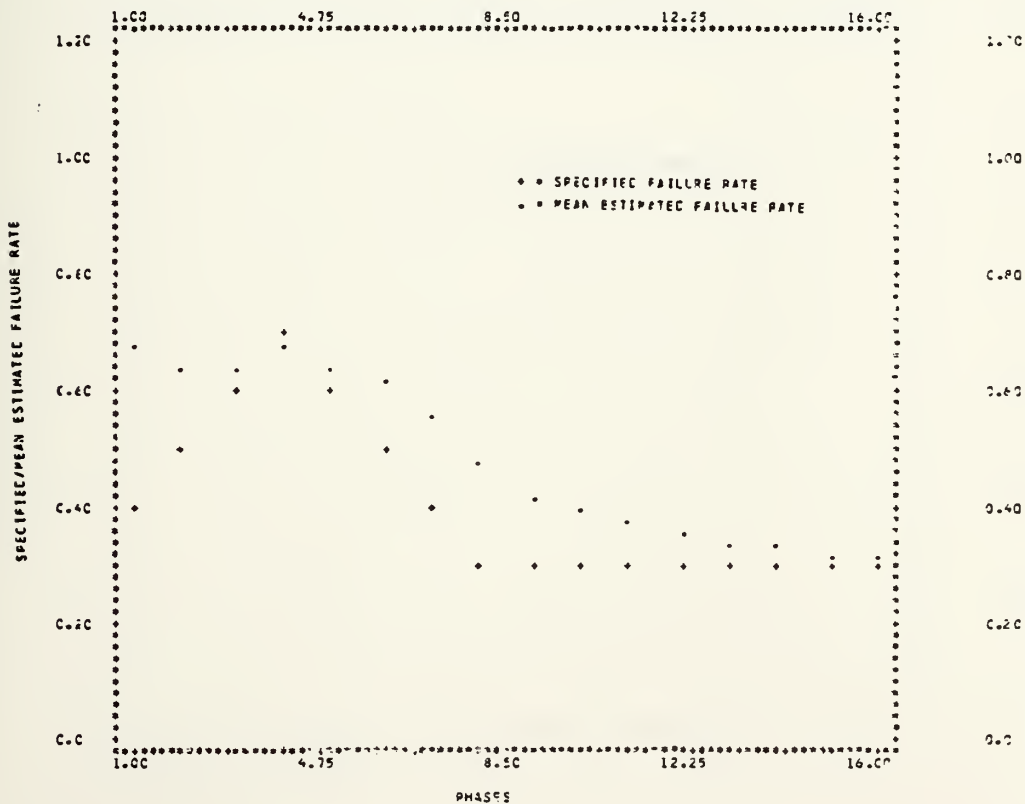
| PHASE   | 9       | 10      | 11      | 12      | 13      | 14      | 15      | 16      |
|---|---------|---------|---------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.3000  | 0.3000  | 0.3000  | 0.3000  | 0.3000  | 0.3000  | 0.3000  | 0.3000  |
| PLANNED TEST TIME                                   | 0.5417  | 0.5417  | 0.5417  | 0.5417  | 0.5417  | 0.5417  | 0.5417  | 0.5417  |
| MODEL ESTIMATE                                      | 0.4192  | 0.3746  | 0.3629  | 0.3511  | 0.3335  | 0.3275  | 0.3236  | 0.3170  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 39.74   | 24.87   | 20.96   | 17.03   | 11.17   | 6.16    | 7.85    | 6.93    |
| SAMPLE STD DEVIATION                                | 0.1591  | 0.1346  | 0.1224  | 0.1043  | 0.0947  | 0.0857  | 0.0848  | 0.0819  |
| CUMULATIVE TEST TIME                                | 30.701  | 35.758  | 40.712  | 45.666  | 50.700  | 55.666  | 60.678  | 65.682  |
| CUMULATIVE FAILURES                                 | 13.3500 | 14.6700 | 16.3000 | 17.9000 | 19.3100 | 20.6100 | 22.4500 | 22.9800 |





| PHASE   | 1      | 2      | 3      | 4       | 5       | 6       | 7       | 8       |
|---|--------|--------|--------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.4000 | 0.5000 | 0.6000 | 0.7000  | 0.8000  | 0.9000  | 0.4000  | 0.3700  |
| PLANNED TEST TIME                                   | 0.4063 | 0.3250 | 0.2709 | 0.2372  | 0.2709  | 0.3250  | 0.4063  | 0.5417  |
| MODEL ESTIMATE                                      | 0.6868 | 0.6447 | 0.6330 | 0.6711  | 0.6484  | 0.6114  | 0.5569  | 0.4782  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 71.69  | 28.93  | 5.49   | 4.13    | 8.06    | 22.29   | 39.23   | 56.39   |
| SAMPLE STD DEVIATION                                | 0.5298 | 0.4113 | 0.2714 | 0.2612  | 0.2510  | 0.1863  | 0.1641  | 0.1298  |
| CUMULATIVE TEST TIME                                | 7.471  | 13.447 | 18.470 | 22.792  | 27.821  | 33.814  | 41.254  | 51.174  |
| CUMULATIVE FAILURES                                 | 3.1300 | 6.2100 | 9.0700 | 11.8200 | 14.5800 | 17.6400 | 20.8200 | 24.1000 |

| PHASE   | 9       | 10      | 11      | 12      | 13      | 14      | 15      | 16      |
|---|---------|---------|---------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.3000  | 0.3000  | 0.3000  | 0.3000  | 0.3000  | 0.3000  | 0.3000  | 0.3000  |
| PLANNED TEST TIME                                   | 0.5417  | 0.5417  | 0.5417  | 0.5417  | 0.5417  | 0.5417  | 0.5417  | 0.5417  |
| MODEL ESTIMATE                                      | 0.4262  | 0.3918  | 0.3705  | 0.3522  | 0.3414  | 0.3312  | 0.3224  | 0.3160  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 42.08   | 30.61   | 23.50   | 17.41   | 13.81   | 10.29   | 7.45    | 5.37    |
| SAMPLE STD DEVIATION                                | 0.1045  | 0.0925  | 0.0849  | 0.0719  | 0.0686  | 0.0643  | 0.0627  | 0.0651  |
| CUMULATIVE TEST TIME                                | 61.120  | 71.108  | 81.071  | 91.080  | 101.031 | 110.972 | 120.975 | 130.999 |
| CUMULATIVE FAILURES                                 | 27.1500 | 30.1500 | 33.2400 | 36.1800 | 39.2700 | 42.2000 | 45.1700 | 48.0900 |

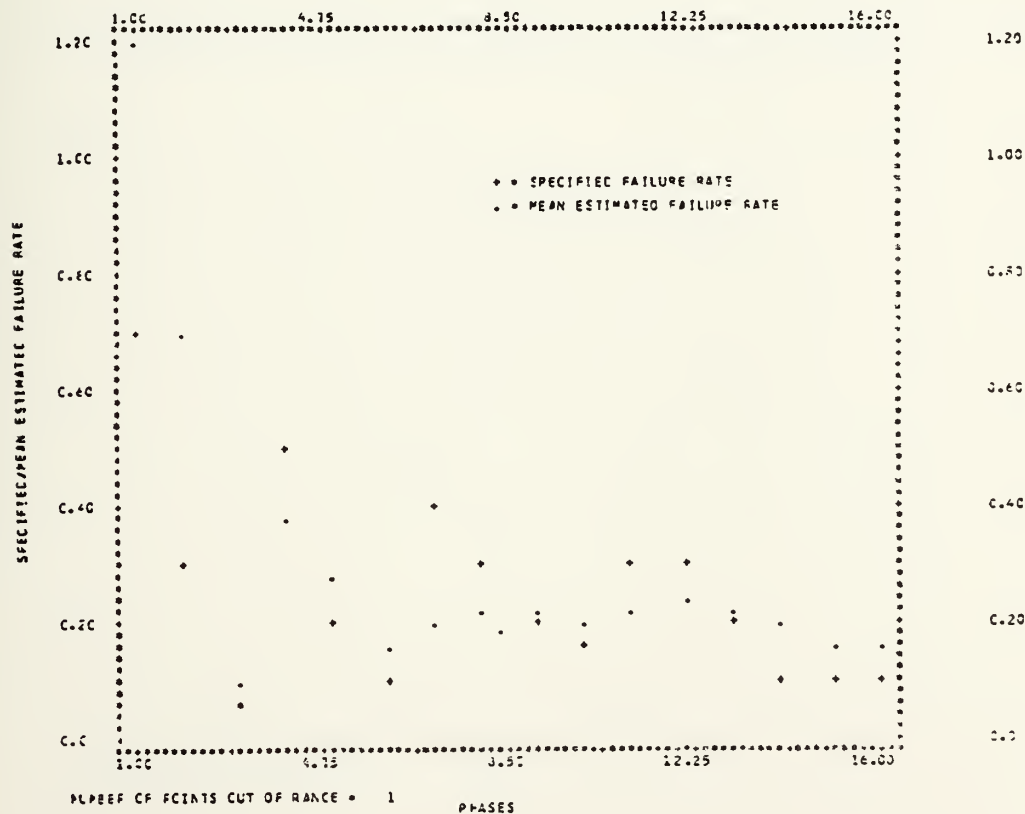






| PHASE   | 1       | 2      | 3      | 4      | 5      | 6      | 7      | 8      |
|---|---------|--------|--------|--------|--------|--------|--------|--------|
| ACTUAL FAILURE RATE                                 | 0.1000  | 0.3000 | 0.0500 | 0.5000 | 0.2000 | 0.1000 | 0.4000 | 0.3000 |
| PLANNED TEST TIME                                   | 0.2322  | 0.5417 | 3.2504 | 0.3250 | 0.8126 | 1.6252 | 0.4063 | 0.5417 |
| MCCEL ESTIMATE                                      | 43.2422 | 0.6972 | 0.1078 | 0.3765 | 0.2858 | 0.1635 | 0.1910 | 0.2181 |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 6077.45 | 132.40 | 115.52 | 24.71  | 42.89  | 63.54  | 92.26  | 27.31  |
| SAMPLE STC DEVIATION                                | *****   | 0.6149 | 0.1108 | 0.1281 | 0.3788 | 0.1745 | 0.1773 | 0.7238 |
| CUMULATIVE TEST TIME                                | 1.074   | 3.573  | 10.481 | 15.990 | 23.722 | 31.225 | 33.112 | 35.575 |
| CUMULATIVE FAILURES                                 | 0.7500  | 1.5200 | 2.2500 | 2.9500 | 3.7600 | 4.5700 | 5.1400 | 5.9300 |

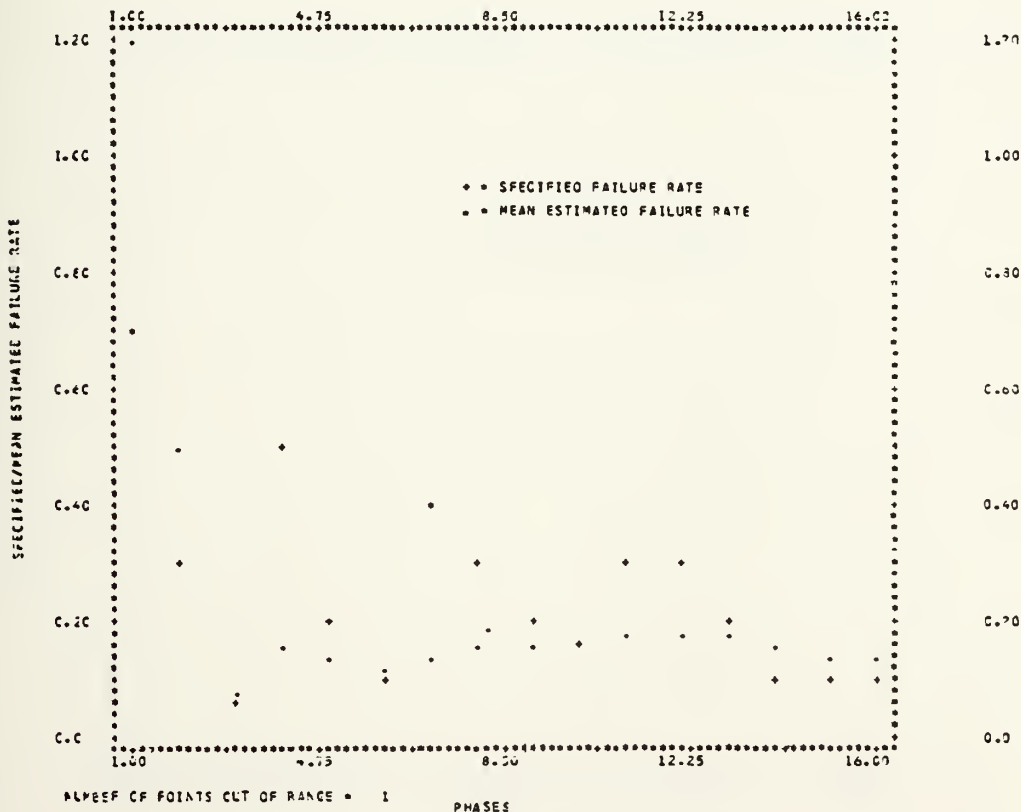
| PHASE   | 9      | 10     | 11     | 12     | 13     | 14      | 15      | 16      |
|---|--------|--------|--------|--------|--------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.2000 | 0.1500 | 0.3000 | 0.3000 | 0.2000 | 0.1000  | 0.1000  | 0.1000  |
| PLANNED TEST TIME                                   | 0.8126 | 1.0235 | 0.5417 | 0.5417 | 0.8126 | 1.6252  | 1.6252  | 1.6252  |
| MCCEL ESTIMATE                                      | 0.2127 | 0.2011 | 0.2208 | 0.2304 | 0.2295 | 0.1959  | 0.1686  | 0.1518  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 6.35   | 34.08  | 26.39  | 23.19  | 14.76  | 55.68   | 68.59   | 51.61   |
| SAMPLE STC DEVIATION                                | 0.1944 | 0.1887 | 0.1710 | 0.1586 | 0.1455 | 0.1124  | 0.0865  | 0.0777  |
| CUMULATIVE TEST TIME                                | 39.351 | 44.288 | 46.786 | 49.254 | 53.005 | 60.464  | 66.097  | 74.729  |
| CUMULATIVE FAILURES                                 | 6.6500 | 7.5000 | 8.3100 | 9.1700 | 9.9600 | 10.7100 | 11.3500 | 11.9500 |





| PHASE   | 1      | 2      | 3      | 4      | 5      | 6      | 7       | 8       |
|---|--------|--------|--------|--------|--------|--------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.3000 | 0.0500 | 0.5000 | 0.2000 | 0.1000 | 0.4000  | 0.3000  |
| PLANNED TEST TIME                                   | 0.2322 | 0.5417 | 3.2504 | 0.3750 | 0.8126 | 1.6252 | 0.4063  | 0.5417  |
| MODEL ESTIMATE                                      | 1.6614 | 0.4541 | 0.0789 | 0.1567 | 0.1448 | 0.1105 | 0.1385  | 0.1541  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 137.34 | 64.68  | 57.86  | 68.67  | 27.61  | 10.47  | 65.36   | 48.65   |
| SAMPLE STD DEVIATION                                | 1.6267 | 0.5024 | 0.1076 | 0.3366 | 0.1564 | 0.0636 | 0.0857  | 0.0777  |
| CUMULATIVE TEST TIME                                | 2.104  | 7.063  | 37.101 | 40.105 | 47.606 | 62.576 | 66.304  | 71.262  |
| CUMULATIVE FAILURES                                 | 1.7700 | 3.3500 | 4.8900 | 6.3500 | 7.9200 | 9.3600 | 10.9800 | 12.5500 |

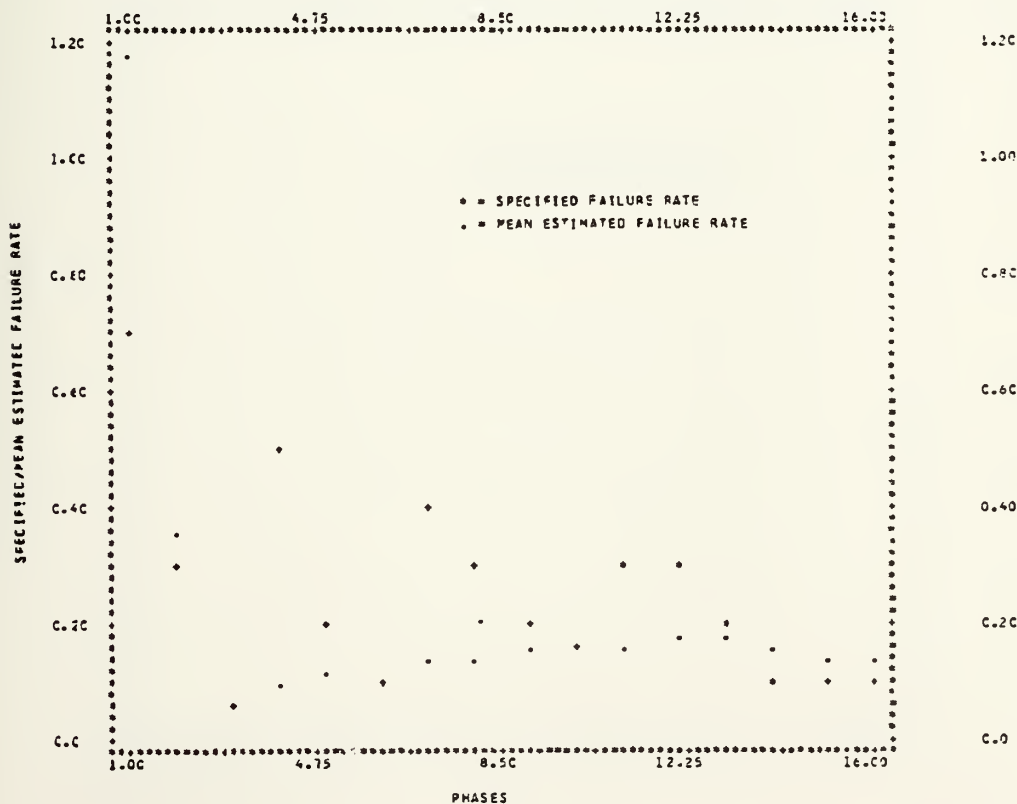
| PHASE   | 9       | 10      | 11      | 12      | 13      | 14      | 15      | 16      |
|---|---------|---------|---------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.2000  | 0.1500  | 0.3000  | 0.3000  | 0.2000  | 0.1000  | 0.1000  | 0.1000  |
| PLANNED TEST TIME                                   | 0.8126  | 1.0835  | 0.5417  | 0.5417  | 0.8126  | 1.6252  | 1.6252  | 1.6252  |
| MODEL ESTIMATE                                      | 0.1600  | 0.1580  | 0.1742  | 0.1838  | 0.1828  | 0.1622  | 0.1459  | 0.1411  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 19.98   | 5.31    | 41.54   | 38.74   | 8.60    | 62.15   | 45.85   | 41.12   |
| SAMPLE STD DEVIATION                                | 0.0893  | 0.0838  | 0.0939  | 0.0920  | 0.0822  | 0.0667  | 0.0547  | 0.0520  |
| CUMULATIVE TEST TIME                                | 76.788  | 88.725  | 93.707  | 98.702  | 106.248 | 121.205 | 136.257 | 151.192 |
| CUMULATIVE FAILURES                                 | 13.9500 | 15.5700 | 17.1800 | 18.6800 | 20.1100 | 21.6400 | 23.2900 | 24.6700 |





| PHASE   | 1      | 2      | 3      | 4       | 5       | 6       | 7       | 8       |
|---|--------|--------|--------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.3000 | 0.0500 | 0.5000  | 0.2000  | 0.1000  | 0.4000  | 0.3000  |
| PLANNED TEST TIME                                   | 0.2322 | 0.5417 | 3.2504 | 0.3250  | 0.8126  | 1.6252  | 0.4063  | 0.5417  |
| MODEL ESTIMATE                                      | 1.1828 | 0.3303 | 0.0600 | 0.0928  | 0.1123  | 0.1035  | 0.1308  | 0.1500  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 68.98  | 16.77  | 19.92  | 81.45   | 43.85   | 3.48    | 67.20   | 50.00   |
| SAMPLE STD DEVIATION                                | 1.3274 | 0.1967 | 0.0259 | 0.0401  | 0.0442  | 0.0357  | 0.0493  | 0.0519  |
| CUMULATIVE TEST TIME                                | 4.272  | 14.288 | 74.066 | 80.098  | 95.034  | 124.911 | 132.346 | 142.278 |
| CUMULATIVE FAILURES                                 | 2.9900 | 5.8500 | 9.0000 | 11.7600 | 14.8800 | 18.0500 | 21.3200 | 24.4500 |

| PHASE   | 9       | 10      | 11      | 12      | 13      | 14      | 15      | 16      |
|---|---------|---------|---------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.2000  | 0.1500  | 0.3000  | 0.3000  | 0.2000  | 0.1000  | 0.1000  | 0.1000  |
| PLANNED TEST TIME                                   | 0.8126  | 1.0835  | 0.5417  | 0.5417  | 0.8126  | 1.6252  | 1.6252  | 1.6252  |
| MODEL ESTIMATE                                      | 0.1560  | 0.1532  | 0.1658  | 0.1800  | 0.1817  | 0.1621  | 0.1479  | 0.1378  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 22.01   | 2.10    | 44.73   | 40.01   | 5.15    | 63.13   | 47.65   | 37.75   |
| SAMPLE STD DEVIATION                                | 0.0518  | 0.0465  | 0.0486  | 0.0463  | 0.0456  | 0.0410  | 0.0332  | 0.0301  |
| CUMULATIVE TEST TIME                                | 157.243 | 177.242 | 187.247 | 197.196 | 212.194 | 242.173 | 272.258 | 302.306 |
| CUMULATIVE FAILURES                                 | 27.4000 | 30.4300 | 33.4100 | 36.6600 | 35.6100 | 42.6600 | 45.4900 | 48.4300 |



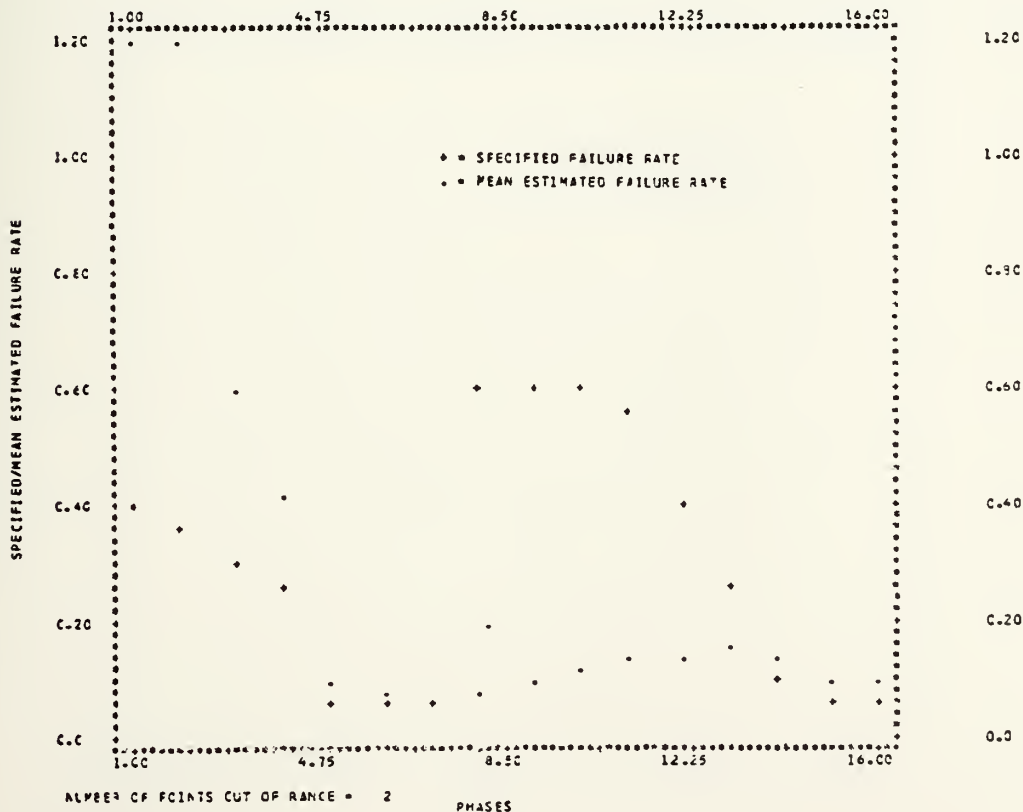


CASE 16

5 ITEMS

| PHASE   | 1      | 2       | 3      | 4      | 5      | 6      | 7      | 8      |
|---|--------|---------|--------|--------|--------|--------|--------|--------|
| ACTUAL FAILURE RATE                                 | 0.4000 | 0.3500  | 0.3000 | 0.2500 | 0.0500 | 0.0500 | 0.0500 | 0.6000 |
| PLANNED TEST TIME                                   | 0.4063 | 0.4663  | 0.5417 | 0.6501 | 3.2504 | 3.2504 | 3.2504 | 0.2709 |
| MCOEL ESTIMATE                                      | 2.2716 | 2.3319  | 0.5924 | 0.4192 | 0.1090 | 0.0749 | 0.0596 | 0.0749 |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 467.91 | 566.25  | 97.46  | 67.66  | 118.06 | 45.76  | 19.25  | 87.52  |
| SAMPLE STD DEVIATION                                | 4.7638 | 12.3516 | 0.5611 | 0.2692 | 0.0689 | 0.0458 | 0.0371 | 0.0400 |
| CUMULATIVE TEST TIME                                | 1.878  | 3.569   | 6.457  | 9.450  | 24.581 | 35.528 | 54.650 | 55.895 |
| CUMULATIVE FAILURES                                 | 0.6500 | 1.6200  | 2.3800 | 3.1900 | 3.9200 | 4.6500 | 5.4300 | 6.1700 |

| PHASE   | 9      | 10     | 11     | 12     | 13      | 14      | 15      | 16      |
|---|--------|--------|--------|--------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.6000 | 0.6000 | 0.5500 | 0.4000 | 0.2500  | 0.1000  | 0.0500  | 0.0500  |
| PLANNED TEST TIME                                   | 0.2709 | 0.2709 | 0.2955 | 0.4063 | 0.6501  | 1.6252  | 3.2504  | 3.2504  |
| MCOEL ESTIMATE                                      | 0.0907 | 0.1168 | 0.1339 | 0.1486 | 0.1601  | 0.1440  | 0.1097  | 0.0910  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 84.89  | 80.53  | 75.65  | 62.86  | 35.97   | 42.95   | 115.38  | 31.99   |
| SAMPLE STD DEVIATION                                | 0.0534 | 0.0828 | 0.0629 | 0.0892 | 0.0594  | 0.0792  | 0.0512  | 0.0403  |
| CUMULATIVE TEST TIME                                | 57.150 | 58.270 | 59.730 | 61.603 | 64.563  | 72.116  | 87.265  | 102.556 |
| CUMULATIVE FAILURES                                 | 6.8500 | 7.7700 | 8.5000 | 9.2300 | 10.0100 | 10.6900 | 11.3100 | 11.9300 |

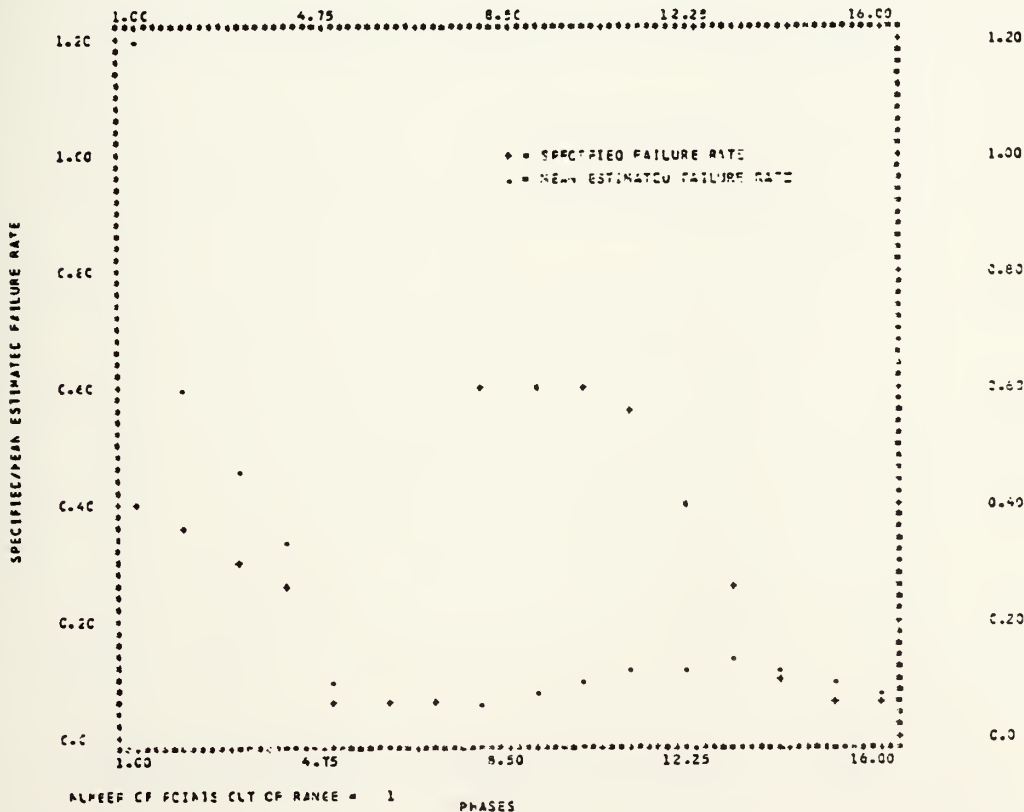






| PHASE   | 1      | 2      | 3      | 4      | 5      | 6      | 7       | 8       |
|---|--------|--------|--------|--------|--------|--------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.4000 | 0.3500 | 0.3000 | 0.2500 | 0.0500 | 0.0500 | 0.0500  | 0.6000  |
| PLANNED TEST TIME                                   | 0.4063 | 0.4643 | 0.5417 | 0.6501 | 3.2504 | 3.2504 | 3.2504  | 0.2709  |
| MODEL ESTIMATE                                      | 1.3527 | 0.6009 | 0.4657 | 0.3459 | 0.1024 | 0.0667 | 0.0523  | 0.0645  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 248.18 | 71.69  | 55.24  | 38.35  | 104.88 | 33.46  | 4.66    | 89.24   |
| SAMPLE STD DEVIATION                                | 2.2082 | 0.4355 | 0.2904 | 0.1796 | 0.0450 | 0.0263 | 0.0184  | 0.0246  |
| CUMULATIVE TEST TIME                                | 3.724  | 7.987  | 12.941 | 18.954 | 48.688 | 78.725 | 108.938 | 111.465 |
| CUMULATIVE FAILURES                                 | 1.6400 | 3.2700 | 4.9400 | 6.4400 | 8.0500 | 9.4600 | 10.7700 | 12.1100 |

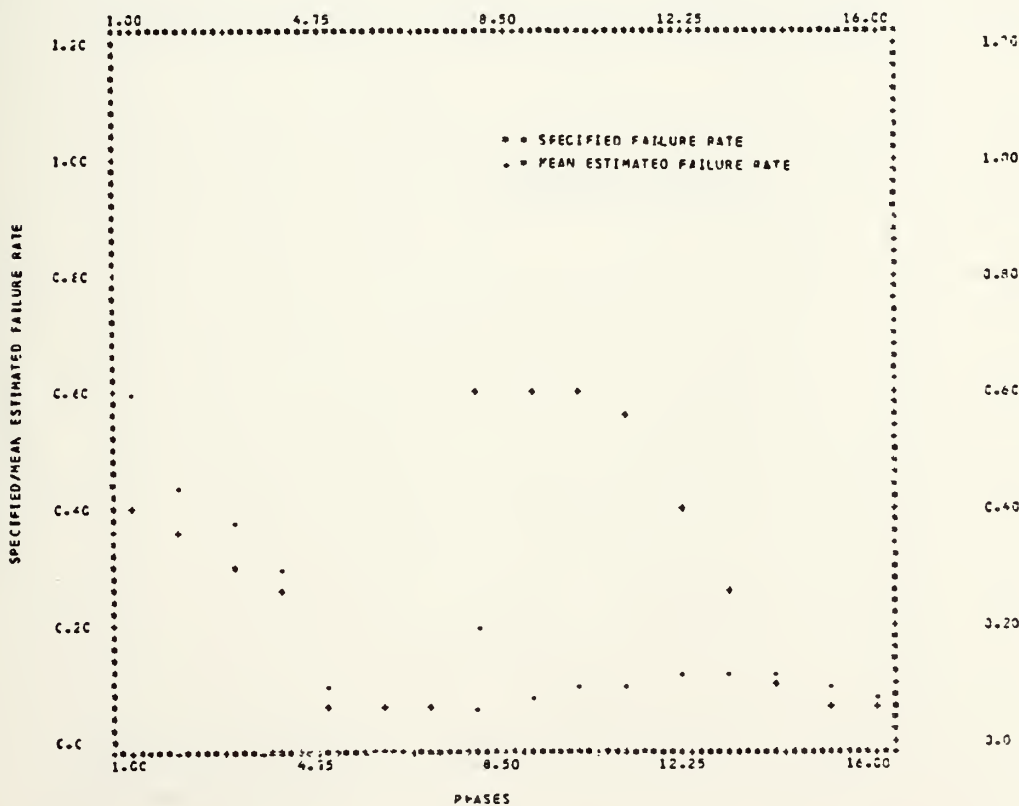
| PHASE   | 9       | 10      | 11      | 12      | 13      | 14      | 15      | 16      |
|---|---------|---------|---------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.6000  | 0.6000  | 0.5500  | 0.4000  | 0.2500  | 0.1000  | 0.0500  | 0.0500  |
| PLANNED TEST TIME                                   | 0.2709  | 0.2709  | 0.2955  | 0.4063  | 0.6501  | 1.6252  | 3.2504  | 3.2504  |
| MODEL ESTIMATE                                      | 0.0791  | 0.0560  | 0.1133  | 0.1764  | 0.1347  | 0.1240  | 0.1011  | 0.0670  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 86.81   | 84.00   | 79.40   | 68.41   | 46.12   | 24.04   | 102.18  | 73.55   |
| SAMPLE STD DEVIATION                                | 0.0286  | 0.0357  | 0.0409  | 0.0431  | 0.0438  | 0.0386  | 0.0263  | 0.0220  |
| CUMULATIVE TEST TIME                                | 113.966 | 116.459 | 119.164 | 122.893 | 128.903 | 144.121 | 173.911 | 203.609 |
| CUMULATIVE FAILURES                                 | 13.6500 | 15.2600 | 16.3700 | 18.3700 | 19.8300 | 21.1000 | 22.6700 | 24.1600 |





| PHASE   | 1      | 2      | 3      | 4       | 5       | 6       | 7       | 8       |
|---|--------|--------|--------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.4000 | 0.3500 | 0.3000 | 0.2500  | 0.0500  | 0.0500  | 0.0500  | 0.4000  |
| PLANNED TEST TIME                                   | 0.4063 | 0.4643 | 0.5417 | 0.6501  | 3.2504  | 3.2504  | 3.2504  | 0.2705  |
| MODEL ESTIMATE                                      | 0.5557 | 0.4452 | 0.3736 | 0.3096  | 0.0908  | 0.0618  | 0.0506  | 0.0637  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 49.92  | 27.15  | 24.54  | 23.32   | 81.51   | 23.62   | 1.18    | 85.38   |
| SAMPLE STD DEVIATION                                | 0.4130 | 0.2285 | 0.1584 | 0.1179  | 0.0316  | 0.0183  | 0.0146  | 0.0178  |
| CUMULATIVE TEST TIME                                | 7.498  | 16.057 | 26.036 | 38.054  | 58.276  | 158.310 | 218.639 | 223.662 |
| CUMULATIVE FAILURES                                 | 3.0000 | 6.1600 | 9.3600 | 12.3800 | 15.1500 | 18.1500 | 20.9600 | 23.5200 |

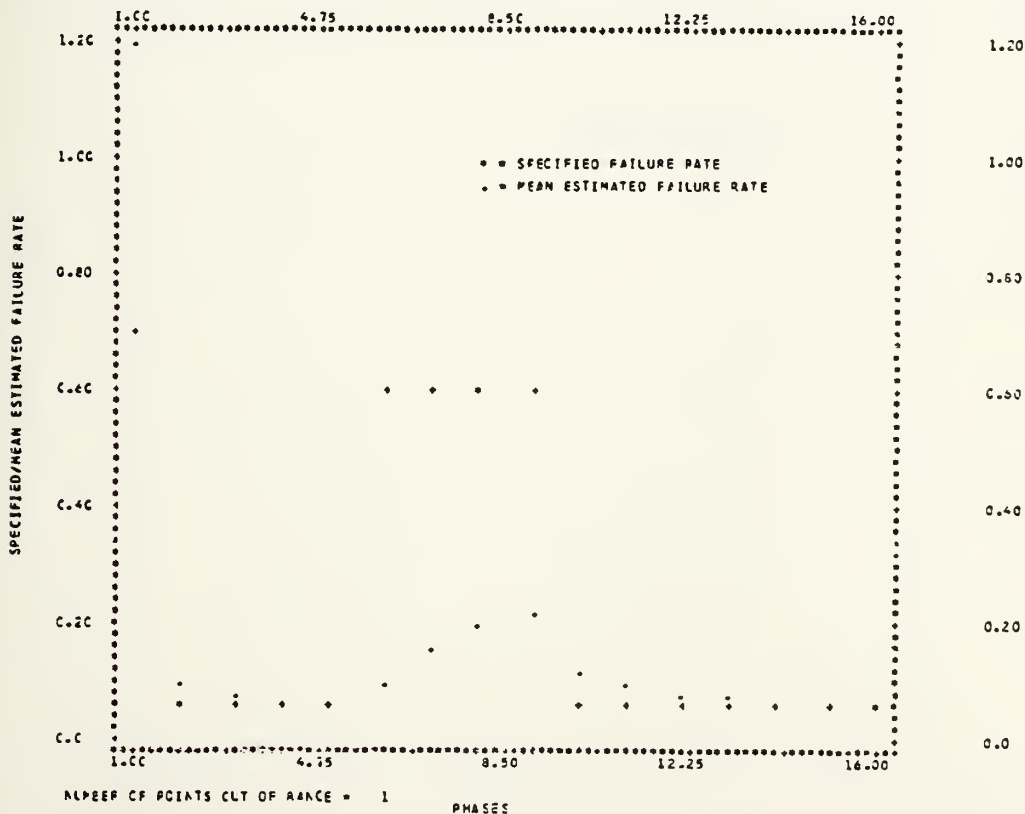
| PHASE   | 9       | 10      | 11      | 12      | 13      | 14      | 15      | 16      |
|---|---------|---------|---------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.6000  | 0.6000  | 0.5500  | 0.4000  | 0.2500  | 0.1000  | 0.0500  | 0.0500  |
| PLANNED TEST TIME                                   | 0.2709  | 0.2709  | 0.2555  | 0.4063  | 0.6501  | 1.6252  | 3.2504  | 3.2504  |
| MODEL ESTIMATE                                      | 0.0767  | 0.0505  | 0.1064  | 0.1189  | 0.1266  | 0.1150  | 0.0663  | 0.0842  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 87.21   | 84.52   | 80.66   | 70.26   | 45.36   | 18.58   | 53.57   | 67.52   |
| SAMPLE STD DEVIATION                                | 0.0193  | 0.0218  | 0.0258  | 0.0276  | 0.0297  | 0.0268  | 0.0209  | 0.0168  |
| CUMULATIVE TEST TIME                                | 226.655 | 233.718 | 235.165 | 246.732 | 258.833 | 285.011 | 348.652 | 408.775 |
| CUMULATIVE FAILURES                                 | 26.7100 | 29.5700 | 32.6700 | 35.5200 | 38.2800 | 41.0500 | 43.9100 | 46.9500 |





| PHASE   | 1      | 2      | 3      | 4      | 5      | 6      | 7      | 8      |
|---|--------|--------|--------|--------|--------|--------|--------|--------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.0500 | 0.0500 | 0.0500 | 0.0500 | 0.6000 | 0.6000 | 0.6000 |
| PLANNED TEST TIME                                   | 0.2322 | 3.2504 | 3.2504 | 3.2504 | 3.2504 | 0.2709 | 0.2709 | 0.2709 |
| MODEL ESTIMATE                                      | 3.1219 | 0.1046 | 0.0767 | 0.0553 | 0.0540 | 0.1088 | 0.1657 | 0.2002 |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 345.98 | 109.20 | 53.34  | 10.56  | 7.96   | 81.67  | 72.25  | 66.64  |
| SAMPLE STD DEVIATION                                | 4.3245 | 0.1278 | 0.1014 | 0.0368 | 0.0371 | 0.1726 | 0.2576 | 0.4368 |
| CUMULATIVE TEST TIME                                | 1.074  | 16.100 | 31.132 | 46.144 | 61.089 | 62.342 | 63.584 | 64.847 |
| CUMULATIVE FAILURES                                 | 0.7300 | 1.6500 | 2.4000 | 3.1800 | 3.9800 | 4.7500 | 5.9600 | 6.2300 |

| PHASE   | 9      | 10     | 11     | 12      | 13      | 14      | 15      | 16      |
|---|--------|--------|--------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.6000 | 0.0500 | 0.0500 | 0.0500  | 0.0500  | 0.0500  | 0.0500  | 0.0500  |
| PLANNED TEST TIME                                   | 0.2709 | 3.2504 | 3.2504 | 3.2504  | 3.2504  | 3.2504  | 3.2504  | 3.2504  |
| MODEL ESTIMATE                                      | 0.2253 | 0.1140 | 0.0939 | 0.0803  | 0.0722  | 0.0690  | 0.0672  | 0.0632  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 62.44  | 128.08 | 87.77  | 60.56   | 44.43   | 37.51   | 24.27   | 26.31   |
| SAMPLE STD DEVIATION                                | 0.4964 | 0.0759 | 0.0561 | 0.0404  | 0.0328  | 0.0311  | 0.0297  | 0.0259  |
| CUMULATIVE TEST TIME                                | 66.090 | 81.203 | 95.926 | 110.912 | 125.809 | 140.723 | 155.586 | 170.701 |
| CUMULATIVE FAILURES                                 | 7.0100 | 7.7100 | 8.5400 | 9.2800  | 10.0300 | 10.8300 | 11.7400 | 12.4900 |



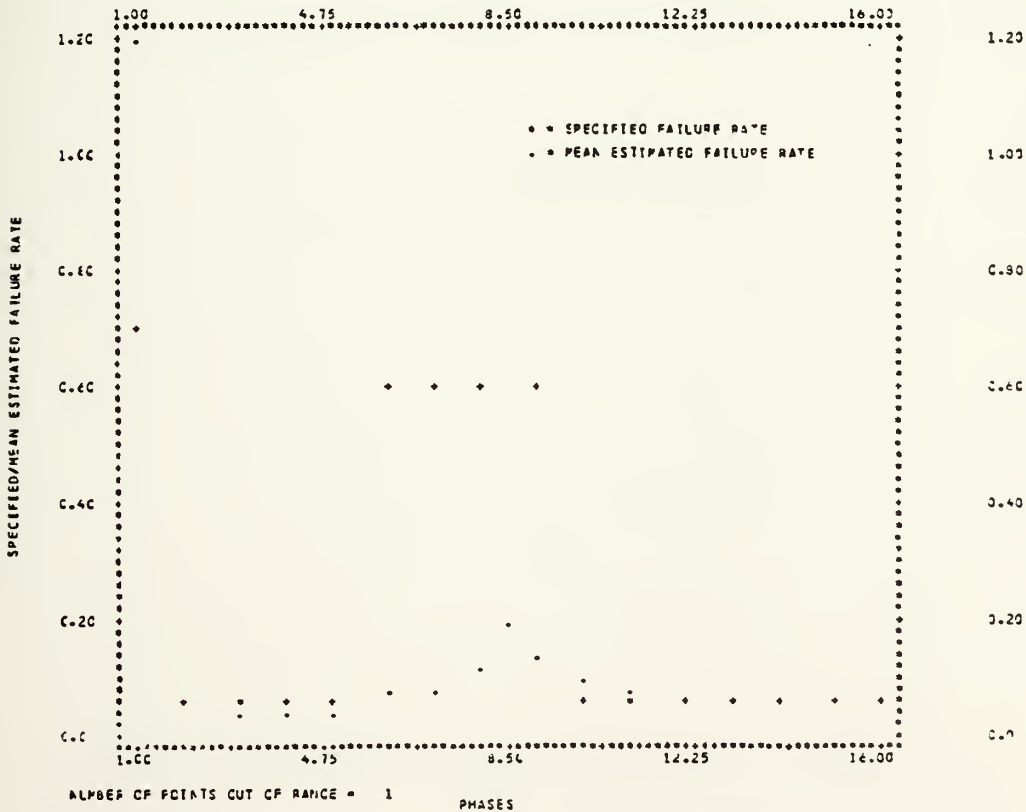


CASE 17

10 TESTS

| PHASE   | 1      | 2      | 3      | 4      | 5       | 6       | 7       | 8       |
|---|--------|--------|--------|--------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.0500 | 0.0500 | 0.0500 | 0.0500  | 0.0000  | 0.0000  | 0.0000  |
| PLANNED TEST TIME                                   | 0.2322 | 3.2504 | 3.2504 | 3.2504 | 3.2504  | 0.2709  | 0.2709  | 0.2709  |
| MODEL ESTIMATE                                      | 1.8160 | 0.0566 | 0.0405 | 0.0444 | 0.0445  | 0.0707  | 0.0857  | 0.1162  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 159.43 | 13.12  | 19.01  | 11.24  | 11.08   | 88.21   | 85.04   | 80.64   |
| SAMPLE STD DEVIATION                                | 3.5101 | 0.0580 | 0.0252 | 0.0368 | 0.0333  | 0.0560  | 0.1254  | 0.1591  |
| CUMULATIVE TEST TIME                                | 2.147  | 32.677 | 62.841 | 92.878 | 122.973 | 125.450 | 126.010 | 130.935 |
| CUMULATIVE FAILURES                                 | 1.4200 | 2.6500 | 4.1200 | 5.6300 | 7.1400  | 8.5500  | 9.8700  | 11.1500 |

| PHASE   | 9       | 10      | 11      | 12      | 13      | 14      | 15      | 16      |
|---|---------|---------|---------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.0000  | 0.0500  | 0.0500  | 0.0500  | 0.0500  | 0.0500  | 0.0500  | 0.0500  |
| PLANNED TEST TIME                                   | 0.2709  | 3.2504  | 3.2504  | 3.2504  | 3.2504  | 3.2504  | 3.2504  | 3.2504  |
| MODEL ESTIMATE                                      | 0.1420  | 0.0533  | 0.0783  | 0.0892  | 0.0651  | 0.0609  | 0.0575  | 0.0550  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 76.34   | 86.68   | 56.52   | 38.39   | 30.16   | 21.75   | 15.73   | 10.08   |
| SAMPLE STD DEVIATION                                | 0.2162  | 0.0514  | 0.0361  | 0.0275  | 0.0237  | 0.0220  | 0.0199  | 0.0168  |
| CUMULATIVE TEST TIME                                | 133.023 | 163.148 | 193.286 | 223.606 | 253.301 | 283.464 | 313.431 | 343.632 |
| CUMULATIVE FAILURES                                 | 12.7400 | 14.2100 | 15.5500 | 17.0100 | 18.6400 | 19.9500 | 21.4200 | 22.8200 |

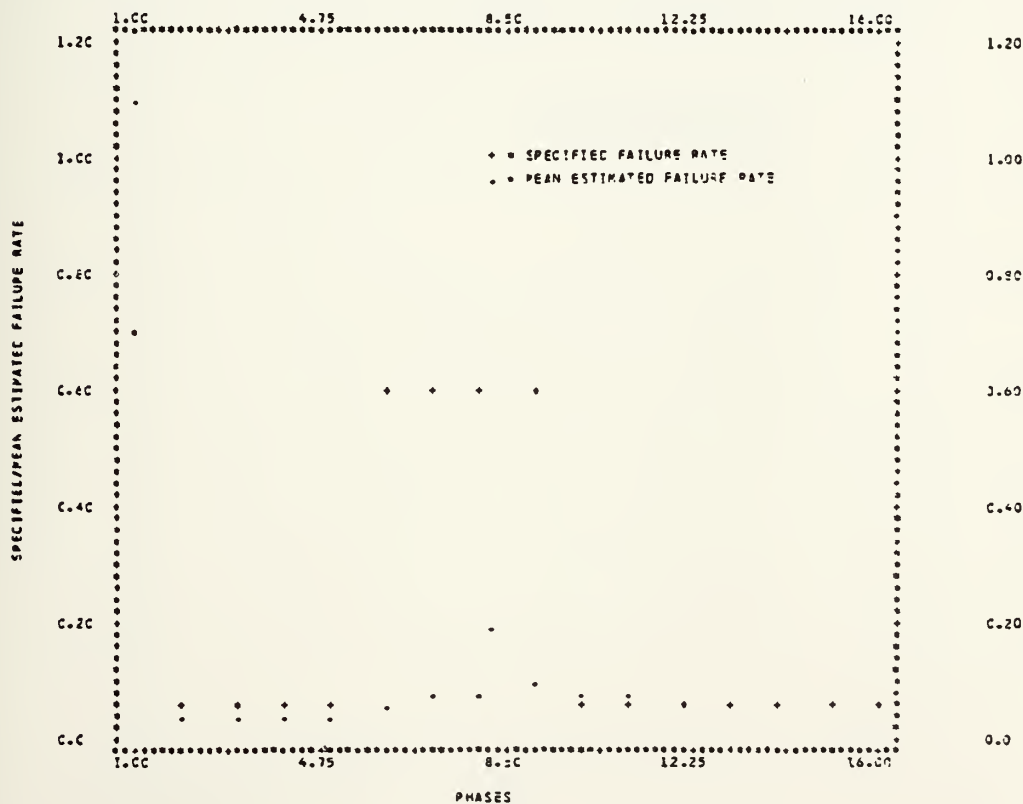






| PHASE   | 1      | 2      | 3       | 4       | 5       | 6       | 7       | 8       |
|---|--------|--------|---------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.0500 | 0.0500  | 0.0500  | 0.0500  | 0.6000  | 0.0000  | 0.0000  |
| PLANNED TEST TIME                                   | 0.2322 | 3.2504 | 3.2504  | 3.2504  | 3.2504  | 0.2709  | 0.2709  | 0.2709  |
| MODEL ESTIMATE                                      | 1.0939 | 0.0455 | 0.0398  | 0.0379  | 0.0373  | 0.0523  | 0.0709  | 0.0896  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 56.27  | 0.58   | 20.45   | 24.12   | 25.47   | 91.12   | 88.19   | 85.23   |
| SAMPLE STD DEVIATION                                | 1.0963 | 0.0273 | 0.0214  | 0.0182  | 0.0144  | 0.0231  | 0.0304  | 0.0372  |
| CUMULATIVE TEST TIME                                | 4.301  | 64.276 | 124.450 | 184.981 | 245.142 | 250.164 | 250.160 | 260.155 |
| CUMULATIVE FAILURES                                 | 2.9200 | 6.0200 | 8.8500  | 11.8100 | 14.7000 | 17.7500 | 20.7900 | 23.6700 |

| PHASE   | 9       | 10      | 11      | 12      | 13      | 14      | 15      | 16      |
|---|---------|---------|---------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.6000  | 0.0500  | 0.0500  | 0.0500  | 0.0500  | 0.0500  | 0.0900  | 0.0500  |
| PLANNED TEST TIME                                   | 0.2709  | 3.2504  | 3.2504  | 3.2504  | 3.2504  | 3.2504  | 3.2504  | 3.2954  |
| MODEL ESTIMATE                                      | 0.1058  | 0.0868  | 0.0755  | 0.0682  | 0.0637  | 0.0591  | 0.0571  | 0.0550  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 82.36   | 73.63   | 50.98   | 36.43   | 27.31   | 18.26   | 14.11   | 10.07   |
| SAMPLE STD DEVIATION                                | 0.0413  | 0.0298  | 0.0232  | 0.0194  | 0.0164  | 0.0146  | 0.0134  | 0.0123  |
| CUMULATIVE TEST TIME                                | 265.205 | 325.017 | 385.302 | 445.457 | 505.314 | 565.618 | 625.928 | 685.722 |
| CUMULATIVE FAILURES                                 | 26.3900 | 29.4800 | 32.5000 | 35.4700 | 38.5600 | 41.2500 | 44.3800 | 47.3300 |



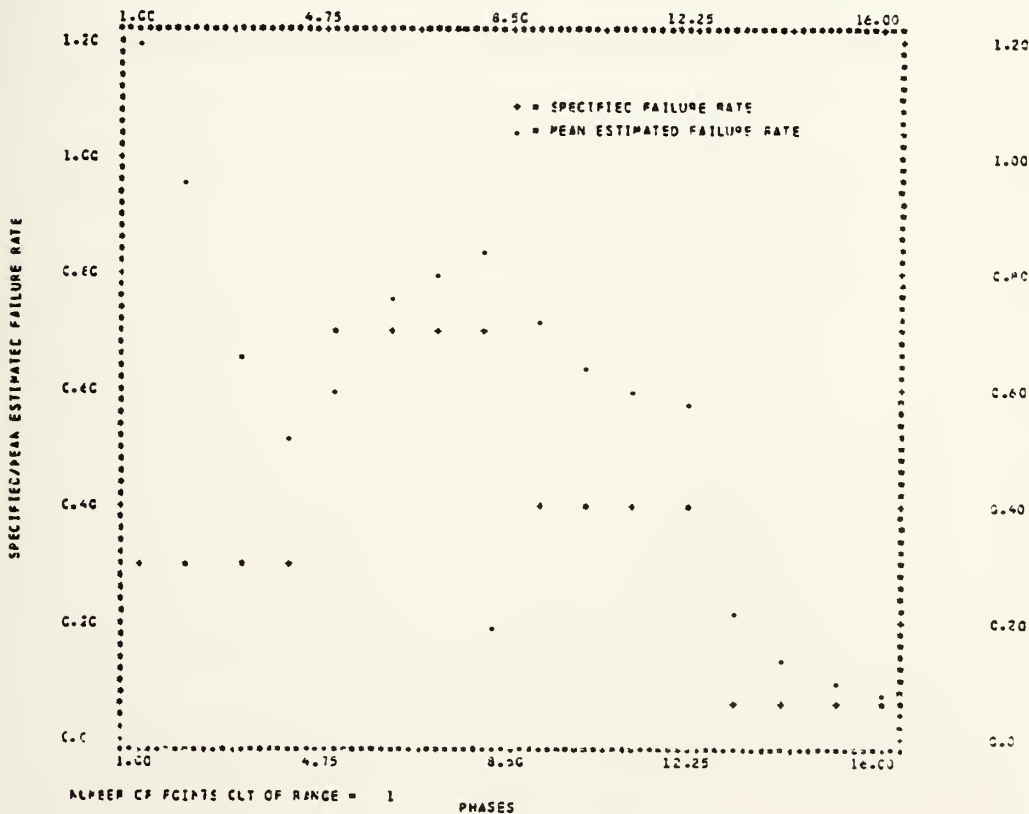


CASE 18

5 LIFE'S

| PHASE   | 1      | 2      | 3      | 4      | 5      | 6      | 7      | 8      |
|---|--------|--------|--------|--------|--------|--------|--------|--------|
| ACTUAL FAILURE RATE                                 | 0.3000 | 0.3000 | 0.3000 | 0.3000 | 0.7000 | 0.7000 | 0.7000 | 0.7000 |
| PLANNED TEST TIME                                   | 0.5417 | 0.5417 | 0.5417 | 0.5417 | 0.2322 | 0.2322 | 0.2322 | 0.2322 |
| MCCEL ESTIMATE                                      | 1.8200 | 0.9681 | 0.6653 | 0.5246 | 0.6058 | 0.7648 | 0.7908 | 0.8333 |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 506.67 | 222.69 | 121.78 | 74.86  | 13.45  | 5.26   | 12.57  | 19.04  |
| SAMPLE STC DEVIATION                                | 4.7804 | 2.3516 | 0.7554 | 0.5055 | 0.6397 | 0.6660 | 0.5736 | 0.6003 |
| CUMULATIVE TEST TIME                                | 2.509  | 5.042  | 7.507  | 10.020 | 11.115 | 12.158 | 13.223 | 14.288 |
| CUMULATIVE FAILURES                                 | 0.7100 | 1.4200 | 2.2400 | 2.9400 | 3.2000 | 4.4700 | 5.3700 | 6.1000 |

| PHASE   | 9      | 10     | 11     | 12     | 13     | 14      | 15      | 16      |
|---|--------|--------|--------|--------|--------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.4000 | 0.4000 | 0.4000 | 0.4000 | 0.0500 | 0.0500  | 0.0500  | 0.0500  |
| PLANNED TEST TIME                                   | 0.4063 | 0.4063 | 0.4063 | 0.4063 | 3.2504 | 3.2504  | 3.2504  | 3.2504  |
| MCCEL ESTIMATE                                      | 0.7238 | 0.6428 | 0.5941 | 0.5712 | 0.2266 | 0.1403  | 0.1027  | 0.0841  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 80.94  | 60.69  | 48.51  | 42.75  | 353.20 | 150.61  | 105.42  | 68.28   |
| SAMPLE STC DEVIATION                                | 0.5225 | 0.3726 | 0.3149 | 0.2987 | 0.0908 | 0.0488  | 0.0350  | 0.0230  |
| CUMULATIVE TEST TIME                                | 16.166 | 18.057 | 19.941 | 21.804 | 36.765 | 51.570  | 67.164  | 82.335  |
| CUMULATIVE FAILURES                                 | 6.8200 | 7.5300 | 8.2700 | 9.0700 | 9.9200 | 10.4000 | 11.2000 | 11.9100 |



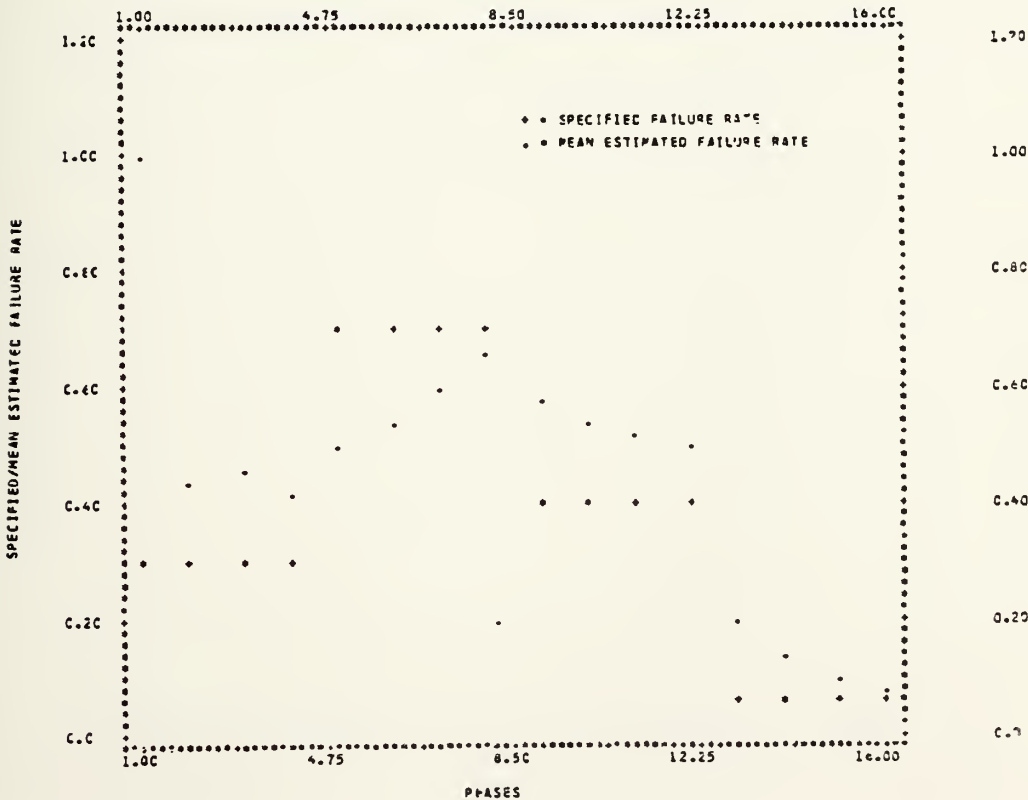


CASE 18

10 TESTS

| PHASE   | 1      | 2      | 3      | 4      | 5      | 6      | 7       | 8       |
|---|--------|--------|--------|--------|--------|--------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.3000 | 0.3000 | 0.3000 | 0.3000 | 0.7000 | 0.7000 | 0.7000  | 0.7000  |
| PLANNED TEST TIME                                   | 0.5417 | 0.5417 | 0.5417 | 0.5417 | 0.7322 | 0.2322 | 0.2322  | 0.2322  |
| MCGEL ESTIMATE                                      | 0.9924 | 0.4334 | 0.4509 | 0.4141 | 0.4922 | 0.3417 | 0.6050  | 0.6507  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 220.81 | 45.14  | 50.31  | 38.03  | 29.69  | 22.61  | 13.57   | 7.05    |
| SAMPLE STD DEVIATION                                | 1.8064 | 0.3275 | 0.3510 | 0.2213 | 0.2896 | 0.3006 | 0.3457  | 0.3053  |
| CUMULATIVE TEST TIME                                | 4.927  | 9.932  | 14.858 | 19.747 | 21.909 | 24.061 | 26.213  | 28.341  |
| CUMULATIVE FAILURES                                 | 1.9500 | 3.0400 | 4.7600 | 6.5600 | 7.9700 | 9.3200 | 10.8400 | 12.4700 |

| PHASE   | 9       | 10      | 11      | 12      | 13      | 14      | 15      | 16      |
|---|---------|---------|---------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.4000  | 0.4000  | 0.4000  | 0.4000  | 0.0500  | 0.0500  | 0.0500  | 0.0500  |
| PLANNED TEST TIME                                   | 0.4063  | 0.4063  | 0.4063  | 0.4063  | 3.2504  | 3.2504  | 3.2504  | 3.2504  |
| MCGEL ESTIMATE                                      | 0.5856  | 0.5325  | 0.5184  | 0.5015  | 0.2063  | 0.1326  | 0.1004  | 0.0829  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 46.41   | 33.12   | 29.61   | 25.38   | 312.54  | 165.13  | 100.70  | 65.73   |
| SAMPLE STD DEVIATION                                | 0.2372  | 0.1869  | 0.1858  | 0.1604  | 0.0580  | 0.0421  | 0.0282  | 0.0230  |
| CUMULATIVE TEST TIME                                | 32.125  | 35.950  | 39.705  | 43.455  | 73.610  | 103.736 | 133.755 | 163.986 |
| CUMULATIVE FAILURES                                 | 13.8200 | 15.0400 | 16.5500 | 16.0700 | 15.4800 | 20.8400 | 22.3300 | 22.8700 |



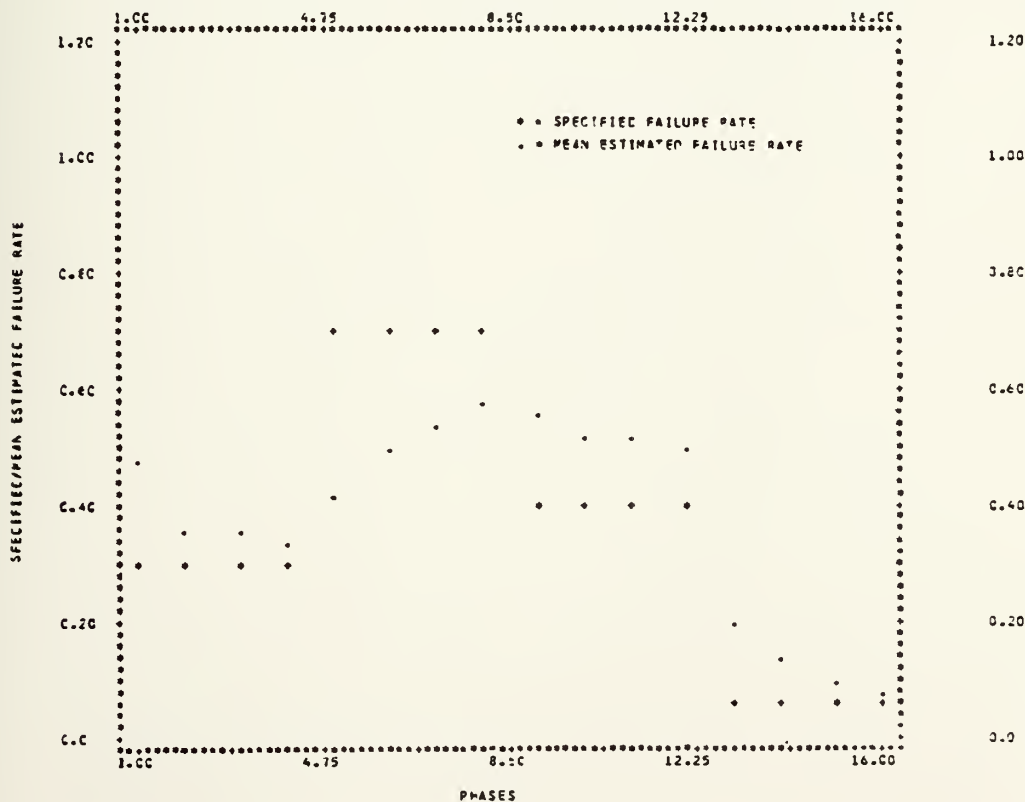


CASE 18

20 STEPS

| PHASE   | 1      | 2      | 3      | 4       | 5       | 6       | 7       | 8       |
|---|--------|--------|--------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.3000 | 0.3000 | 0.3000 | 0.3000  | 0.7000  | 0.7000  | 0.7000  | 0.7000  |
| PLANNED TEST TIME                                   | 0.5417 | 0.5417 | 0.5417 | 0.5417  | 0.2322  | 0.2322  | 0.2322  | 0.2322  |
| MODEL ESTIMATE                                      | 0.4793 | 0.3668 | 0.3657 | 0.3373  | 0.4107  | 0.4909  | 0.5454  | 0.5880  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 59.77  | 22.28  | 21.89  | 12.43   | 41.32   | 29.88   | 22.08   | 16.01   |
| SAMPLE STD DEVIATION                                | 0.4000 | 0.2244 | 0.1727 | 0.1377  | 0.1405  | 0.1751  | 0.1989  | 0.1904  |
| CUMULATIVE TEST TIME                                | 5.996  | 19.986 | 29.990 | 35.908  | 44.206  | 48.479  | 52.744  | 57.039  |
| CUMULATIVE FAILURES                                 | 3.0300 | 5.9000 | 9.1800 | 12.0600 | 14.9400 | 18.1200 | 21.0300 | 23.9900 |

| PHASE   | 9       | 10      | 11      | 12      | 13      | 14      | 15      | 16      |
|---|---------|---------|---------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.4000  | 0.4000  | 0.4000  | 0.4000  | 0.0500  | 0.0500  | 0.0500  | 0.0500  |
| PLANNED TEST TIME                                   | 0.4063  | 0.4063  | 0.4063  | 0.4063  | 3.2504  | 3.2504  | 3.2504  | 3.2504  |
| MODEL ESTIMATE                                      | 0.5920  | 0.5296  | 0.5202  | 0.5038  | 0.2070  | 0.1310  | 0.1005  | 0.0825  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 38.01   | 32.40   | 30.04   | 25.95   | 314.05  | 161.90  | 100.99  | 65.08   |
| SAMPLE STD DEVIATION                                | 0.1544  | 0.1518  | 0.1315  | 0.1207  | 0.0419  | 0.0237  | 0.0184  | 0.0139  |
| CUMULATIVE TEST TIME                                | 64.569  | 72.091  | 79.547  | 87.097  | 147.563 | 208.236 | 267.734 | 327.823 |
| CUMULATIVE FAILURES                                 | 26.9100 | 29.8600 | 33.1100 | 36.0300 | 38.8700 | 41.9400 | 44.8200 | 47.9900 |







## APPENDIX B

### Results of Test 2

This appendix contains the results for Cases 1, 3, 7, and 18. The planned test times were generated for a probability of survival of .99.

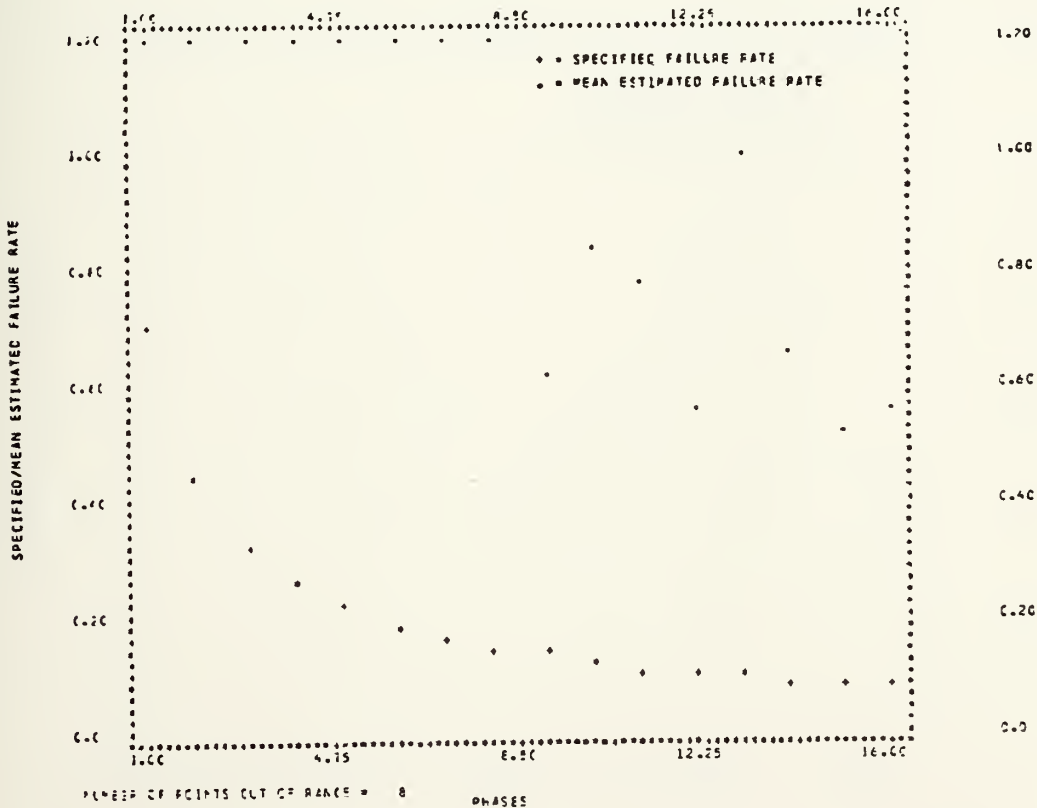
A detailed description of the format of the results can be found in Appendix A.



5 ITEMS

| PHASE   | 1       | 2       | 3       | 4       | 5       | 6       | 7      | 8      |
|---|---------|---------|---------|---------|---------|---------|--------|--------|
| ACTUAL FAILURE RATE                                 | 0.7000  | 0.4340  | 0.3200  | 0.2550  | 0.2130  | 0.1830  | 0.1610 | 0.1440 |
| PLANNED TEST TIME                                   | 0.0143  | 0.0232  | 0.0314  | 0.0394  | 0.0472  | 0.0549  | 0.0624 | 0.0698 |
| MODEL ESTIMATE                                      | 31.8283 | 16.3034 | 9.3556  | 5.7270  | 3.6502  | 2.4186  | 1.2357 | 1.3603 |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 4433.54 | 3656.53 | 1586.12 | 1361.97 | 1612.71 | 1221.66 | 667.57 | 844.63 |
| SAMPLE STD DEVIATION                                | 26.7755 | 18.6836 | 9.3265  | 5.6890  | 3.7668  | 2.3912  | 1.2041 | 1.5657 |
| CUMULATIVE TEST TIME                                | 0.071   | 0.167   | 0.343   | 0.535   | 0.774   | 1.045   | 1.395  | 1.707  |
| CUMULATIVE FAILURES                                 | 0.0300  | 0.0600  | 0.0900  | 0.1300  | 0.1800  | 0.2100  | 0.2300 | 0.2600 |

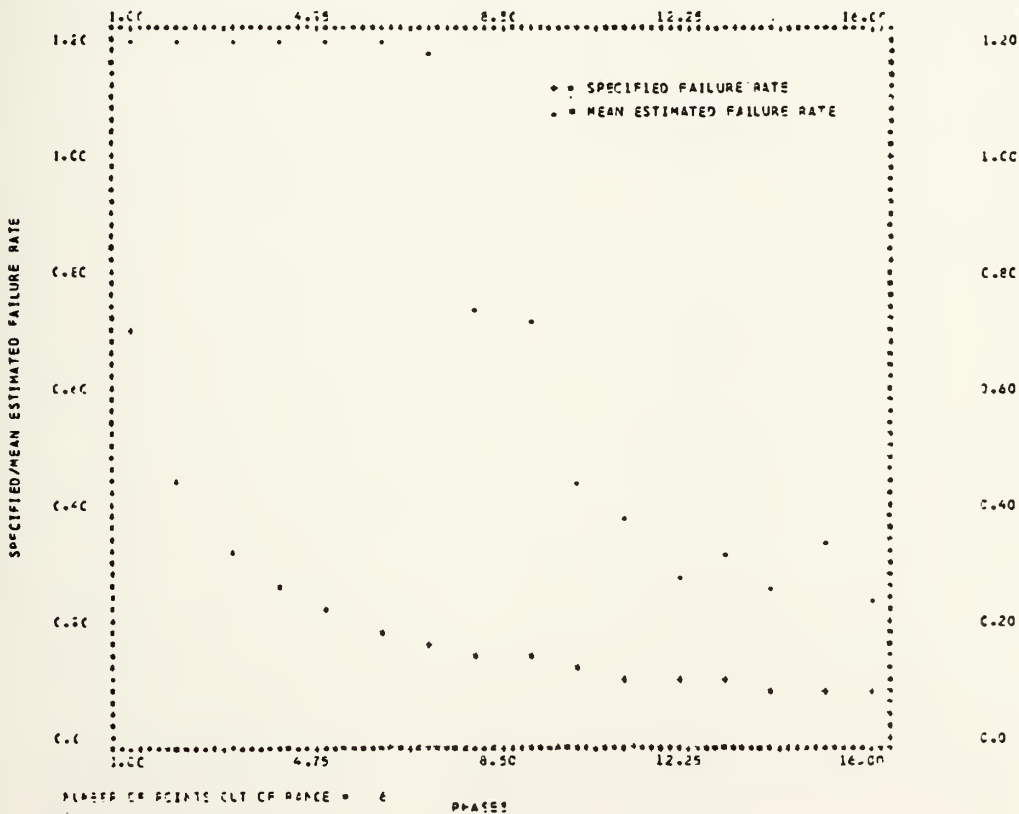
| PHASE   | 9      | 10     | 11     | 12     | 13     | 14     | 15     | 16     |
|---|--------|--------|--------|--------|--------|--------|--------|--------|
| ACTUAL FAILURE RATE                                 | 0.1230 | 0.1180 | 0.1050 | 0.1010 | 0.0936 | 0.0876 | 0.0823 | 0.0776 |
| PLANNED TEST TIME                                   | 0.0736 | 0.0852 | 0.0922 | 0.0995 | 0.1074 | 0.1147 | 0.1221 | 0.1295 |
| MODEL ESTIMATE                                      | 0.6253 | 0.8411 | 0.7862 | 0.5501 | 0.5903 | 0.6264 | 0.5116 | 0.5547 |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 373.19 | 612.81 | 621.28 | 444.63 | 557.96 | 645.32 | 231.62 | 614.80 |
| SAMPLE STD DEVIATION                                | 0.5257 | 1.0848 | 1.2175 | 0.7225 | 2.0628 | 1.4664 | 1.3351 | 0.9917 |
| CUMULATIVE TEST TIME                                | 2.065  | 3.210  | 2.969  | 3.466  | 4.001  | 4.572  | 5.182  | 5.826  |
| CUMULATIVE FAILURES                                 | 0.2500 | 0.3300 | 0.3600 | 0.3800 | 0.4300 | 0.4700 | 0.4800 | 0.5300 |





| PHASE   | 1       | 2      | 3      | 4      | 5      | 6      | 7      | 8      |
|---|---------|--------|--------|--------|--------|--------|--------|--------|
| ACTUAL FAILURE RATE                                 | 0.7020  | 0.4340 | 0.3200 | 0.2550 | 0.2130 | 0.1630 | 0.1610 | 0.1440 |
| FLIPPIC TEST TIME                                   | 0.0143  | 0.0332 | 0.0314 | 0.0394 | 0.0472 | 0.0545 | 0.0624 | 0.0656 |
| MODEL ESTIMATE                                      | 16.3315 | 3.6730 | 2.7172 | 1.4535 | 1.3885 | 1.3654 | 1.1818 | 0.7745 |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 2226.45 | 780.68 | 749.14 | 470.15 | 552.06 | 657.06 | 624.03 | 410.07 |
| SAMPLE STD DEVIATION                                | 17.4622 | 3.6113 | 3.3150 | 1.7987 | 2.3276 | 2.5683 | 2.5258 | 1.4261 |
| CUMULATIVE TEST TIME                                | 0.142   | 0.273  | 0.685  | 1.078  | 1.548  | 2.054  | 2.716  | 3.411  |
| CUMULATIVE FAILURES                                 | 0.1100  | 0.2100 | 0.3200 | 0.3700 | 0.4700 | 0.6000 | 0.6800 | 0.7700 |

| PHASE   | 9      | 10     | 11     | 12     | 13     | 14     | 15     | 16     |
|---|--------|--------|--------|--------|--------|--------|--------|--------|
| ACTUAL FAILURE RATE                                 | 0.1320 | 0.1180 | 0.1050 | 0.1010 | 0.0936 | 0.0876 | 0.0823 | 0.0776 |
| FLIPPIC TEST TIME                                   | 0.0756 | 0.0857 | 0.0922 | 0.0995 | 0.1074 | 0.1147 | 0.1221 | 0.1295 |
| MODEL ESTIMATE                                      | 0.7105 | 0.4429 | 0.3854 | 0.2846 | 0.2354 | 0.2136 | 0.2424 | 0.2336 |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 434.22 | 275.37 | 253.95 | 181.83 | 241.22 | 185.54 | 215.65 | 195.77 |
| SAMPLE STD DEVIATION                                | 1.2661 | 0.4564 | 0.6555 | 0.2998 | 0.5723 | 0.2335 | 0.8563 | 0.2853 |
| CUMULATIVE TEST TIME                                | 4.160  | 5.007  | 5.924  | 6.915  | 7.978  | 9.119  | 10.332 | 11.620 |
| CUMULATIVE FAILURES                                 | 0.9400 | 1.0300 | 1.1200 | 1.2200 | 1.2800 | 1.3100 | 1.6300 | 1.7500 |

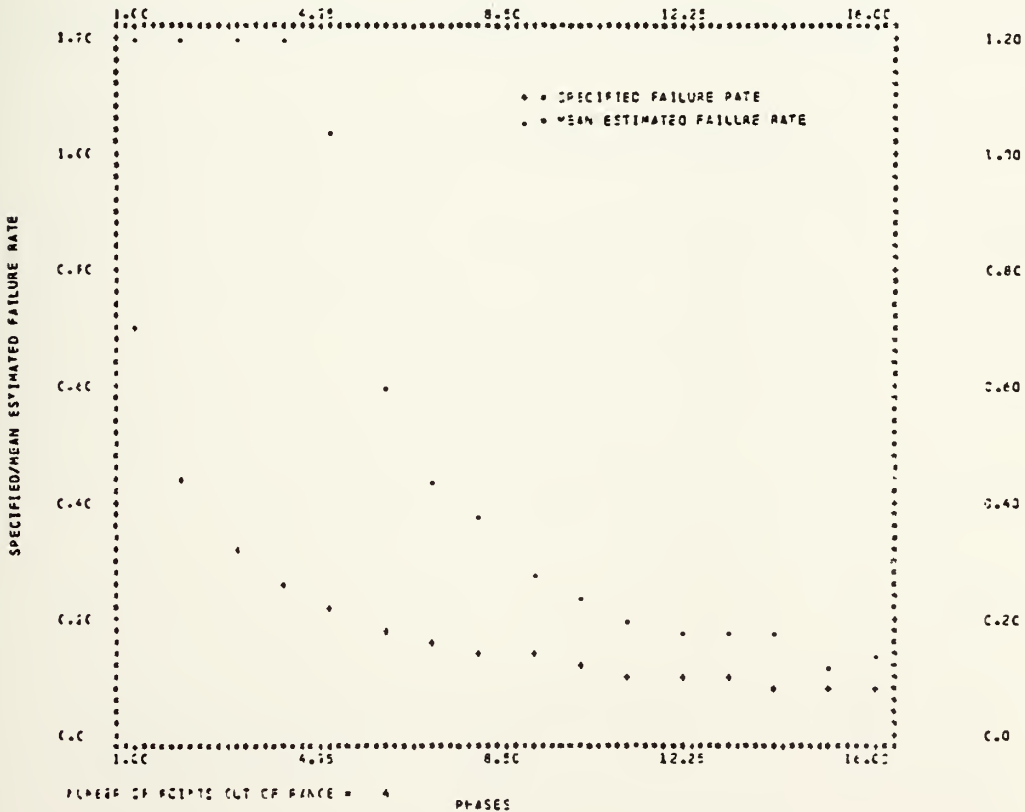




20 ITEMS

| PHASE   | 1       | 2       | 3      | 4       | 5      | 6      | 7      | 8      |
|---|---------|---------|--------|---------|--------|--------|--------|--------|
| ACTUAL FAILURE RATE                                 | 0.7000  | 0.4340  | 0.3200 | 0.2950  | 0.2120 | 0.1630 | 0.1610 | 0.1440 |
| PLANNED TEST TIME                                   | 0.0143  | 0.0232  | 0.0314 | 0.0394  | 0.0472 | 0.0549 | 0.0624 | 0.0698 |
| POCEL ESTIMATE                                      | 7.3617  | 4.5436  | 1.9522 | 3.0595  | 1.0386 | 0.6045 | 0.4370 | 0.3706 |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 951.52  | 1939.09 | 510.00 | 1055.82 | 367.60 | 230.25 | 171.47 | 157.76 |
| SAMPLE STD DEVIATION                                | 11.2572 | 9.8959  | 2.8569 | 10.5748 | 7.5166 | 0.7323 | 0.4325 | 0.7662 |
| CUMULATIVE TEST TIME                                | 0.285   | 0.744   | 1.368  | 2.145   | 3.087  | 4.176  | 5.417  | 6.808  |
| CUMULATIVE FAILURES                                 | 0.2500  | 0.4700  | 0.7300 | 1.0000  | 1.3200 | 1.5900 | 1.8300 | 1.9900 |

| PHASE   | 9      | 10     | 11     | 12     | 13     | 14     | 15     | 16     |
|---|--------|--------|--------|--------|--------|--------|--------|--------|
| ACTUAL FAILURE RATE                                 | 0.1330 | 0.1160 | 0.1090 | 0.1010 | 0.0926 | 0.0876 | 0.0823 | 0.0776 |
| PLANNED TEST TIME                                   | 0.0756 | 0.0632 | 0.0522 | 0.0495 | 0.1074 | 0.1147 | 0.1221 | 0.1295 |
| POCEL ESTIMATE                                      | 0.2642 | 0.2334 | 0.2035 | 0.1782 | 0.1707 | 0.1773 | 0.1241 | 0.1315 |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 113.71 | 57.61  | 87.07  | 76.48  | 62.26  | 102.25 | 50.72  | 65.44  |
| SAMPLE STD DEVIATION                                | 0.4354 | 0.2417 | 0.2268 | 0.2140 | 0.2420 | 0.4362 | 0.0971 | 0.1771 |
| CUMULATIVE TEST TIME                                | 8.312  | 10.006 | 11.844 | 13.824 | 15.960 | 16.246 | 20.675 | 23.250 |
| CUMULATIVE FAILURES                                 | 2.1600 | 2.4300 | 2.5800 | 2.7700 | 3.0100 | 3.1600 | 3.2500 | 3.6200 |



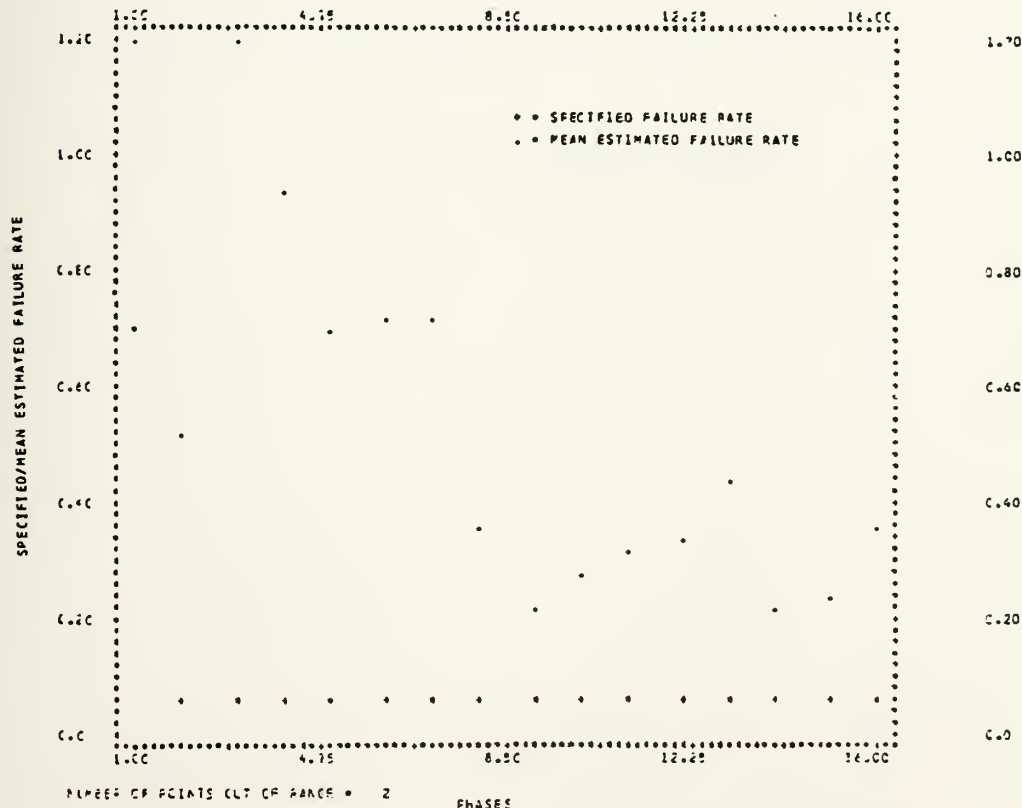




5 STEPS

| PHASE   | 1       | 2      | 3       | 4       | 5       | 6       | 7       | 8      |
|---|---------|--------|---------|---------|---------|---------|---------|--------|
| ACTUAL FAILURE RATE                                 | 0.0500  | 0.0500 | 0.0500  | 0.0500  | 0.0500  | 0.0500  | 0.0500  | 0.0500 |
| PLANNED TEST TIME                                   | 0.0144  | 0.0210 | 0.0210  | 0.0210  | 0.0210  | 0.0210  | 0.0210  | 0.0210 |
| MODEL ESTIMATE                                      | 22.0856 | 0.8139 | 1.9466  | 0.9339  | 0.7089  | 0.7112  | 0.7209  | 0.3252 |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 442.45  | 527.78 | 3833.15 | 1767.81 | 1317.82 | 1322.65 | 1241.74 | 610.50 |
| SAMPLE STD DEVIATION                                | 27.0078 | 0.2128 | 4.5189  | 1.4566  | 1.0879  | 1.0273  | 1.1814  | 0.2200 |
| CUMULATIVE TEST TIME                                | 0.072   | 1.079  | 2.070   | 3.067   | 4.068   | 5.062   | 6.061   | 7.062  |
| CUMULATIVE FAILURES                                 | 0.0500  | 0.0500 | 0.1600  | 0.2300  | 0.2700  | 0.3600  | 0.4300  | 0.4600 |

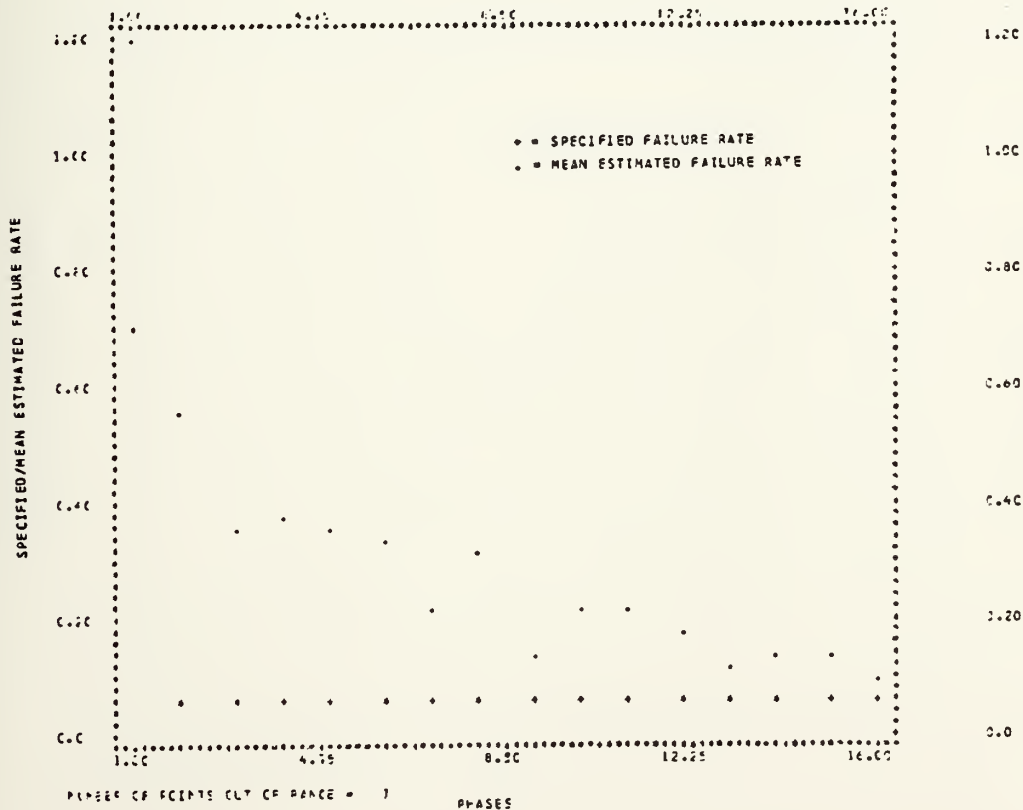
| PHASE   | 9      | 10     | 11     | 12     | 13     | 14     | 15     | 16     |
|---|--------|--------|--------|--------|--------|--------|--------|--------|
| ACTUAL FAILURE RATE                                 | 0.0500 | 0.0500 | 0.0500 | 0.0500 | 0.0500 | 0.0500 | 0.0500 | 0.0500 |
| PLANNED TEST TIME                                   | 0.0210 | 0.0210 | 0.0210 | 0.0210 | 0.0210 | 0.0210 | 0.0210 | 0.0210 |
| MODEL ESTIMATE                                      | 0.2201 | 0.2776 | 0.3250 | 0.3424 | 0.4301 | 0.2221 | 0.2412 | 0.3634 |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 340.23 | 455.10 | 549.59 | 584.87 | 780.16 | 344.18 | 382.57 | 627.22 |
| SAMPLE STD DEVIATION                                | 0.1745 | 0.4572 | 0.8021 | 0.4751 | 0.8258 | 0.2087 | 0.2855 | 0.7954 |
| CUMULATIVE TEST TIME                                | 8.067  | 9.068  | 10.070 | 11.069 | 12.068 | 13.069 | 14.067 | 15.070 |
| CUMULATIVE FAILURES                                 | 0.4700 | 0.5200 | 0.5600 | 0.6400 | 0.7100 | 0.7500 | 0.7900 | 0.8700 |





| PHASE   | 1       | 2       | 3      | 4      | 5      | 6      | 7      | 8      |
|---|---------|---------|--------|--------|--------|--------|--------|--------|
| ACTUAL FAILURE RATE                                 | 0.7000  | 0.0200  | 0.3500 | 0.0500 | 0.0500 | 0.0100 | 0.0200 | 0.0500 |
| PLANNED TEST TIME                                   | 0.0144  | 0.2010  | 0.2010 | 0.2010 | 0.2010 | 0.2010 | 0.2010 | 0.2010 |
| MODEL ESTIMATE                                      | 21.3252 | 0.5628  | 0.3642 | 0.3768 | 0.3535 | 0.3425 | 0.2254 | 0.3172 |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 2947.03 | 1025.00 | 628.43 | 653.64 | 606.92 | 566.55 | 350.68 | 534.42 |
| SAMPLE STD DEVIATION                                | 19.1402 | 1.0382  | 0.5002 | 0.5325 | 0.5064 | 0.4092 | 0.3710 | 0.4074 |
| CUMULATIVE TEST TIME                                | 0.144   | 2.142   | 4.140  | 6.135  | 8.134  | 10.126 | 12.126 | 14.126 |
| CUMULATIVE FAILURES                                 | 0.1300  | 0.2200  | 0.3400 | 0.4600 | 0.6100 | 0.7600 | 0.8600 | 0.9600 |

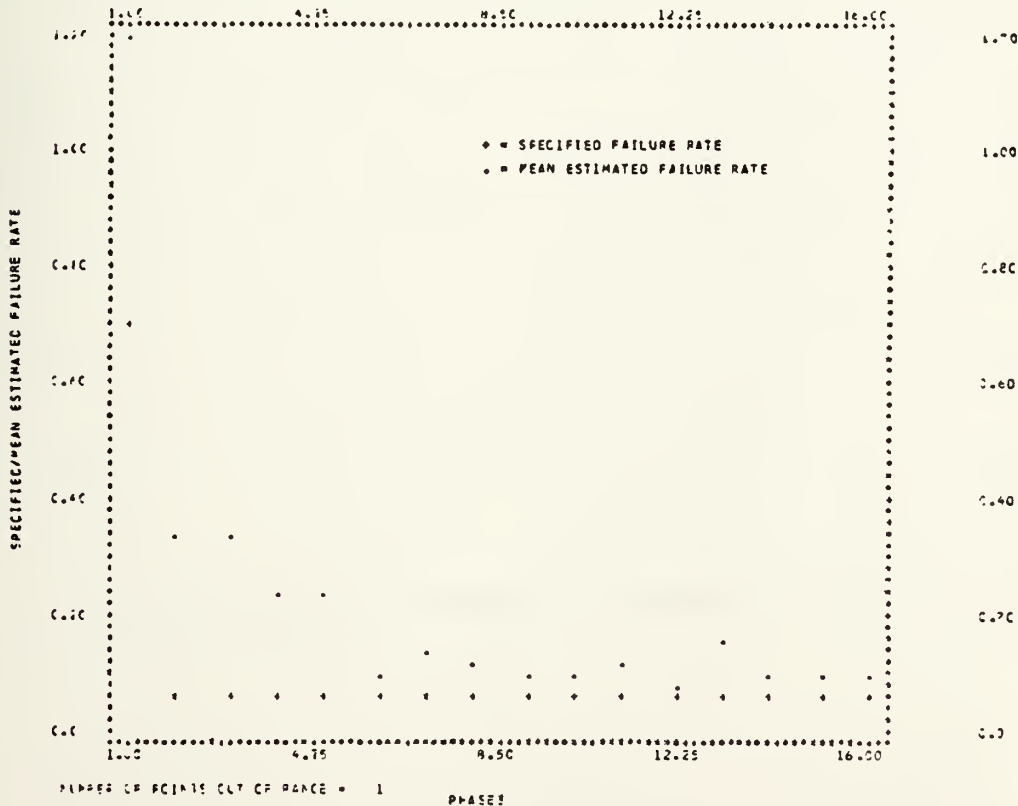
| PHASE   | 9      | 10     | 11     | 12     | 13     | 14     | 15     | 16     |
|---|--------|--------|--------|--------|--------|--------|--------|--------|
| ACTUAL FAILURE RATE                                 | 0.0500 | 0.0300 | 0.0500 | 0.0500 | 0.0500 | 0.0500 | 0.0500 | 0.0500 |
| PLANNED TEST TIME                                   | 0.2010 | 0.2010 | 0.2010 | 0.2010 | 0.2010 | 0.2010 | 0.2010 | 0.2010 |
| MODEL ESTIMATE                                      | 0.1458 | 0.2130 | 0.2102 | 0.1847 | 0.1244 | 0.1221 | 0.1400 | 0.0994 |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 191.58 | 325.94 | 320.48 | 269.46 | 148.66 | 164.19 | 175.95 | 96.72  |
| SAMPLE STD DEVIATION                                | 0.1736 | 0.9055 | 0.4478 | 0.5876 | 0.1471 | 0.2141 | 0.2516 | 0.0995 |
| CUMULATIVE TEST TIME                                | 16.139 | 18.132 | 20.130 | 22.131 | 24.129 | 26.126 | 28.126 | 30.127 |
| CUMULATIVE FAILURES                                 | 1.0100 | 1.0900 | 1.2200 | 1.3000 | 1.4400 | 1.5700 | 1.6800 | 1.7600 |





| PHASE   | 1       | 2      | 3      | 4      | 5      | 6      | 7      | 8      |
|---|---------|--------|--------|--------|--------|--------|--------|--------|
| ACTUAL FAILURE RATE                                 | 0.0000  | 0.0000 | 0.0500 | 0.0500 | 0.0500 | 0.0000 | 0.0500 | 0.0000 |
| PLANNED TEST TIME                                   | 0.0144  | 0.2010 | 0.2010 | 0.2010 | 0.2010 | 0.2010 | 0.2010 | 0.2010 |
| MODEL ESTIMATE                                      | 9.4676  | 0.3441 | 0.3305 | 0.2375 | 0.2337 | 0.1000 | 0.1494 | 0.1124 |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 1252.01 | 566.17 | 560.95 | 574.97 | 367.46 | 111.65 | 198.60 | 124.63 |
| SAMPLE STD DEVIATION                                | 10.0111 | 0.3795 | 0.5101 | 0.3180 | 0.1025 | 0.1261 | 0.2652 | 0.1771 |
| CUMULATIVE TEST TIME                                | 0.206   | 4.684  | 8.265  | 12.280 | 16.289 | 20.252 | 24.288 | 28.292 |
| CUMULATIVE FAILURES                                 | 0.1000  | 0.4100 | 0.6100 | 0.6500 | 0.6400 | 1.1000 | 1.2800 | 1.4500 |

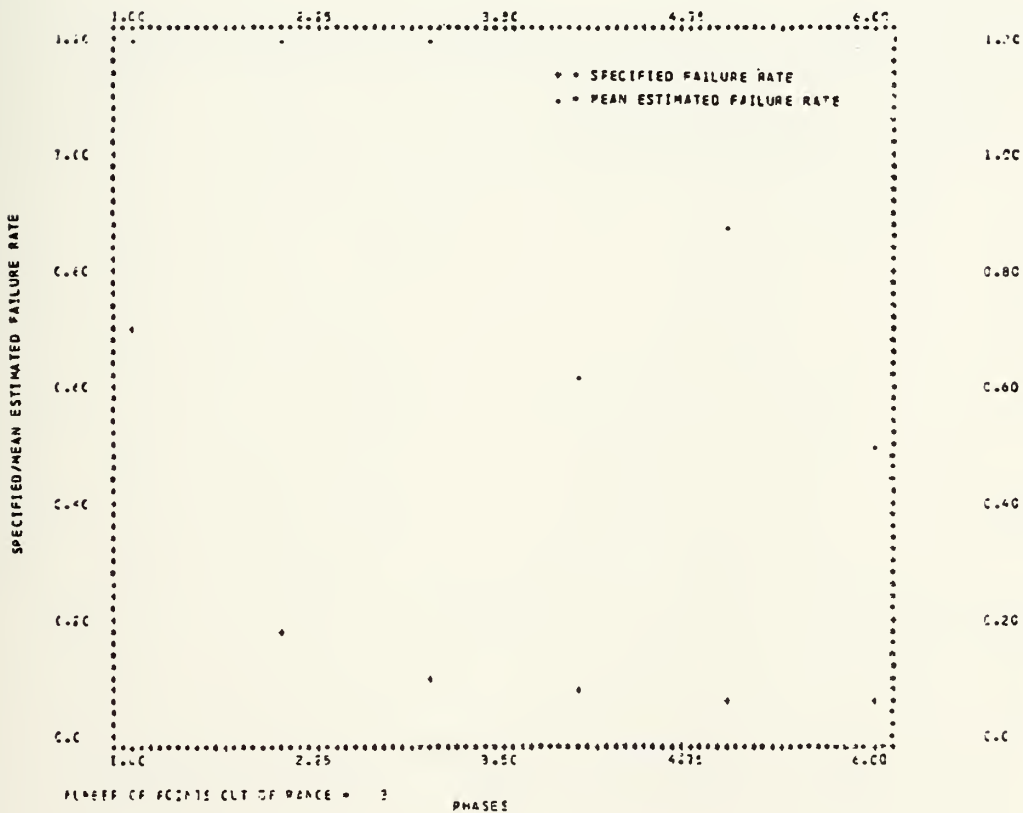
| PHASE   | 9      | 10     | 11     | 12     | 13     | 14     | 15     | 16     |
|---|--------|--------|--------|--------|--------|--------|--------|--------|
| ACTUAL FAILURE RATE                                 | 0.0500 | 0.0000 | 0.0500 | 0.0500 | 0.0500 | 0.0000 | 0.0500 | 0.0500 |
| PLANNED TEST TIME                                   | 0.2010 | 0.2010 | 0.2010 | 0.2010 | 0.2010 | 0.2010 | 0.2010 | 0.2010 |
| MODEL ESTIMATE                                      | 0.0949 | 0.0951 | 0.1205 | 0.0886 | 0.1682 | 0.0948 | 0.1048 | 0.0956 |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 89.15  | 90.24  | 141.01 | 77.27  | 236.47 | 89.51  | 109.60 | 99.29  |
| SAMPLE STD DEVIATION                                | 0.1150 | 0.1267 | 0.1555 | 0.0974 | 0.5486 | 0.1225 | 0.2788 | 0.2009 |
| CUMULATIVE TEST TIME                                | 32.256 | 36.255 | 40.288 | 44.295 | 48.278 | 52.288 | 56.250 | 60.287 |
| CUMULATIVE FAILURES                                 | 1.6000 | 1.8000 | 2.1100 | 2.2400 | 2.6000 | 2.7300 | 2.9000 | 3.1600 |





3 ITEMS

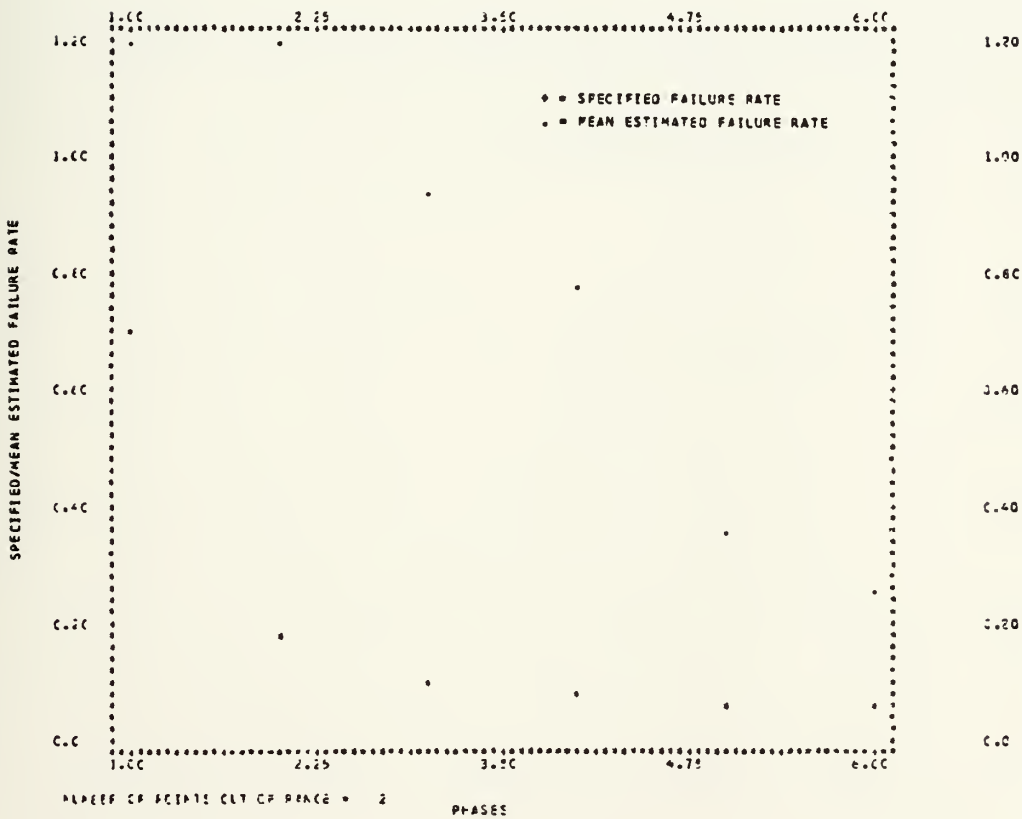
| PHASE   | 1       | 2       | 3       | 4      | 5       | 6      |
|---|---------|---------|---------|--------|---------|--------|
| ACTUAL FAILURE RATE                             | 0.7000  | 0.1800  | 0.1000  | 0.0760 | 0.0600  | 0.0900 |
| PLANNED TEST TIME                               | 0.0144  | 0.0256  | 0.0548  | 0.1322 | 0.1675  | 0.2010 |
| POCEL ESTIMATE                                  | 19.8422 | 4.7637  | 1.3617  | 0.6275 | 0.8815  | 0.5009 |
| INSTANTANEOUS PERCENTAGE OF ACTUAL FAILURE RATE | 2734.59 | 2557.83 | 1164.58 | 725.66 | 1369.16 | 501.74 |
| SAMPLE STD DEVIATION                            | 10.4311 | 6.5765  | 1.5440  | 0.4792 | 0.5550  | 0.4621 |
| CUMULATIVE TEST TIME                            | 0.072   | 0.350   | 0.822   | 1.482  | 2.316   | 3.318  |
| CUMULATIVE FAILURES                             | 0.0300  | 0.0500  | 0.0700  | 0.1000 | 0.1600  | 0.2600 |





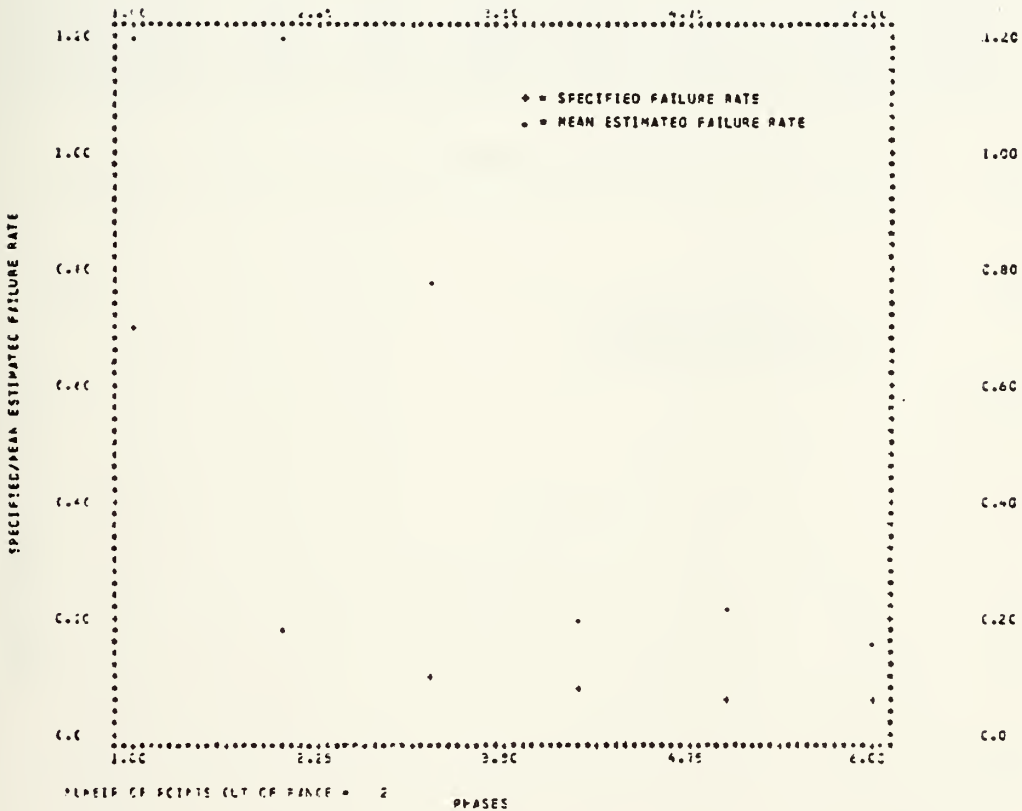


| PHASE   | 1      | 2      | 3      | 4      | 5      | 6      |
|---|--------|--------|--------|--------|--------|--------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.1800 | 0.1060 | 0.0760 | 0.0600 | 0.0500 |
| PLANNED TEST TIME                                   | 0.0144 | 0.0558 | 0.0948 | 0.1322 | 0.1675 | 0.2010 |
| MODEL ESTIMATE                                      | 6.0664 | 1.9283 | 0.9321 | 0.7858 | 0.2577 | 0.2556 |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 766.63 | 749.04 | 719.30 | 533.91 | 456.22 | 415.28 |
| SAMPLE STD DEVIATION                                | 2.0424 | 1.5045 | 1.0662 | 1.7208 | 0.5474 | 0.4262 |
| CUMULATIVE TEST TIME                                | 0.143  | 0.655  | 1.642  | 2.955  | 4.625  | 6.625  |
| CUMULATIVE FAILURES                                 | 0.0700 | 0.1700 | 0.3100 | 0.3800 | 0.4600 | 0.5600 |





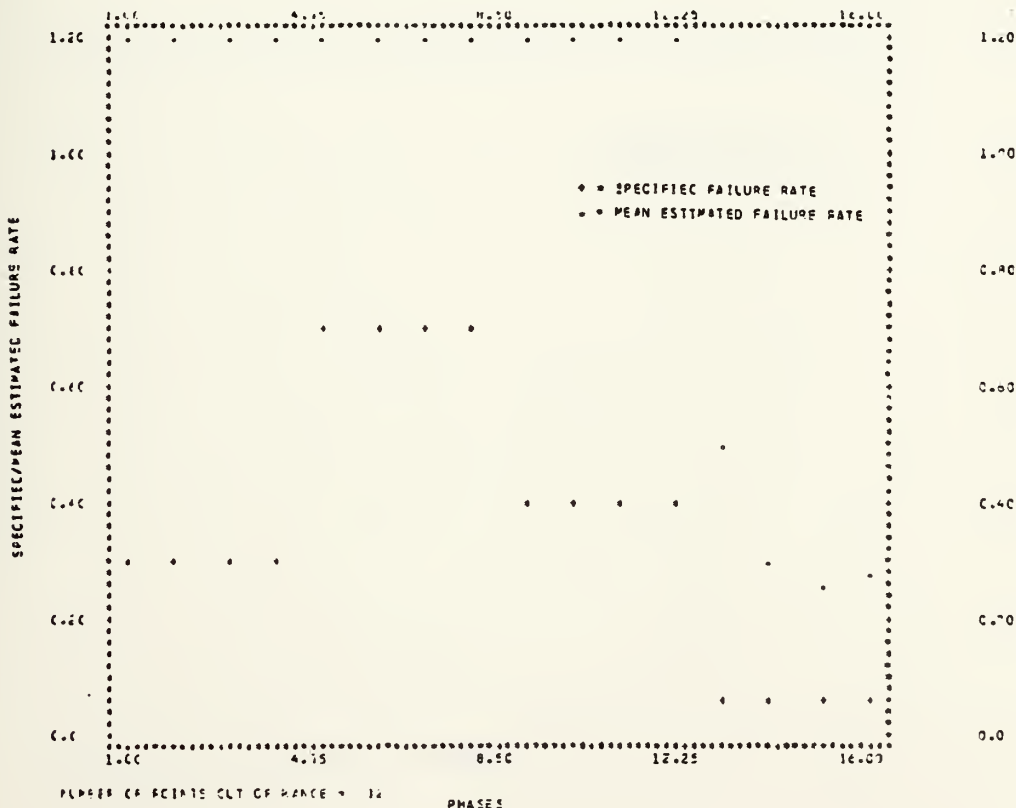
| PHASE   | 1       | 2      | 3      | 4      | 5      | 6      |
|---|---------|--------|--------|--------|--------|--------|
| ACTUAL FAILURE RATE                                 | 0.7000  | 0.1800 | 0.1060 | 0.0760 | 0.0600 | 0.0500 |
| PLANNED TEST TIME                                   | 0.0144  | 0.0258 | 0.0940 | 0.1322 | 0.1675 | 0.2010 |
| MODEL ESTIMATE                                      | 12.0566 | 1.2764 | 0.7800 | 0.2056 | 0.2201 | 0.1574 |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 1622.63 | 610.75 | 635.67 | 171.90 | 266.50 | 214.65 |
| SAMPLE STD DEVIATION                                | 17.3610 | 3.0665 | 1.6882 | 0.1780 | 0.1672 | 0.2551 |
| CUMULATIVE TEST TIME                                | 0.266   | 1.359  | 3.282  | 5.918  | 9.259  | 13.287 |
| CUMULATIVE FAILURES                                 | 0.1700  | 0.3200 | 0.5700 | 0.7200 | 0.8500 | 1.0700 |





| PHASE   | 1       | 2       | 3       | 4       | 5       | 6       | 7      | 8      |
|---|---------|---------|---------|---------|---------|---------|--------|--------|
| ACTUAL FAILURE RATE                                 | 0.3000  | 0.3000  | 0.3000  | 0.3000  | 0.7000  | 0.7000  | 0.7000 | 0.7000 |
| PLANNED TEST TIME                                   | 0.0335  | 0.0335  | 0.0335  | 0.0335  | 0.0144  | 0.0144  | 0.0144 | 0.0144 |
| MOSL ESTIMATE                                       | 15.2324 | 6.5035  | 10.1654 | 4.9846  | 6.2225  | 5.4572  | 2.7474 | 4.6147 |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 4577.81 | 2201.17 | 3288.53 | 1561.55 | 821.78  | 685.32  | 435.34 | 567.61 |
| SAMPLE STD DEVIATION                                | 12.6522 | 8.5245  | 10.3442 | 6.4989  | 14.2165 | 12.5801 | 4.2175 | 6.4702 |
| CUMULATIVE TEST TIME                                | 0.166   | 0.233   | 0.499   | 0.666   | 0.737   | 0.609   | 0.661  | 0.952  |
| CUMULATIVE FAILURES                                 | 0.0400  | 0.0800  | 0.2000  | 0.2500  | 0.2700  | 0.2500  | 0.3300 | 0.4100 |

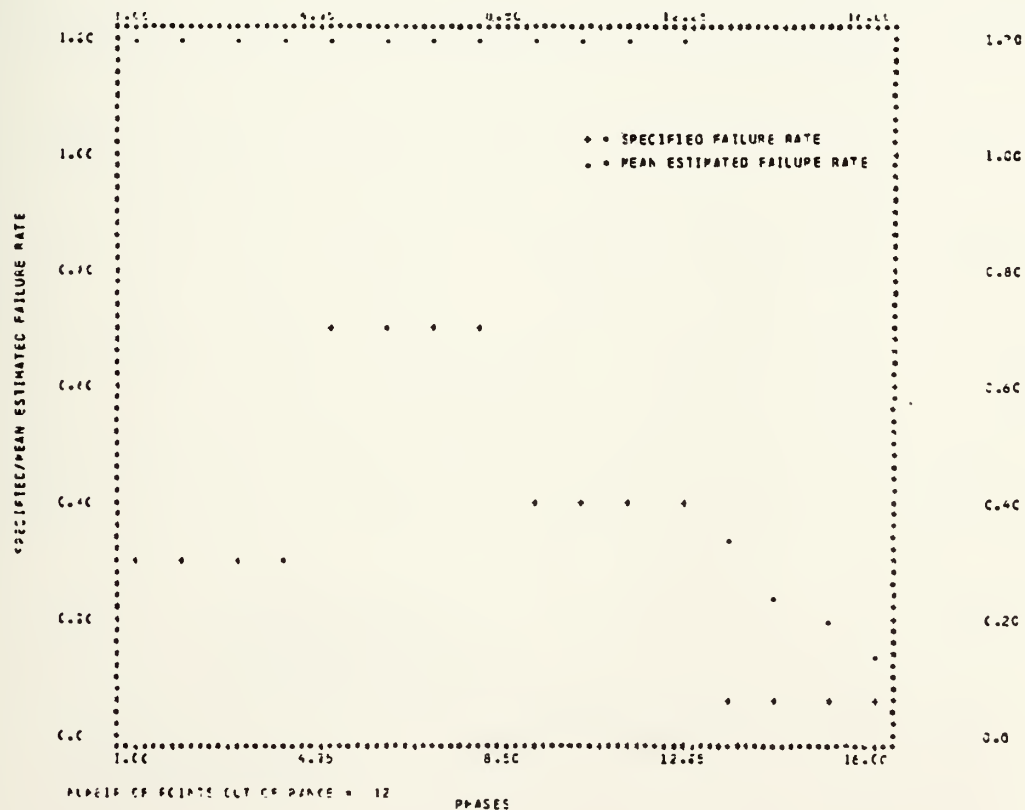
| PHASE   | 9       | 10     | 11     | 12     | 13     | 14     | 15     | 16     |
|---|---------|--------|--------|--------|--------|--------|--------|--------|
| ACTUAL FAILURE RATE                                 | 0.4000  | 0.4000 | 0.4000 | 0.4000 | 0.6500 | 0.6500 | 0.6500 | 0.6500 |
| PLANNED TEST TIME                                   | 0.0251  | 0.0251 | 0.0251 | 0.0251 | 0.2010 | 0.2010 | 0.2010 | 0.2010 |
| MOSL ESTIMATE                                       | 4.5554  | 3.1953 | 3.3009 | 4.1636 | 0.5057 | 0.2563 | 0.2675 | 0.2716 |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 1038.90 | 656.63 | 725.22 | 540.91 | 511.36 | 452.52 | 435.75 | 443.25 |
| SAMPLE STD DEVIATION                                | 6.4262  | 6.2560 | 4.6361 | 8.5508 | 0.2005 | 0.2215 | 0.3555 | 0.6631 |
| CUMULATIVE TEST TIME                                | 1.077   | 1.202  | 1.227  | 1.452  | 2.455  | 3.456  | 4.455  | 5.455  |
| CUMULATIVE FAILURES                                 | 0.4000  | 0.4500 | 0.5800 | 0.6300 | 0.6400 | 0.6700 | 0.7200 | 0.7700 |





| PHASE   | 1       | 2       | 3       | 4      | 5      | 6      | 7      | 8      |
|---|---------|---------|---------|--------|--------|--------|--------|--------|
| ACTUAL FAILURE RATE                                 | 0.3000  | 0.3000  | 0.3000  | 0.3000 | 0.7000 | 0.7000 | 0.7000 | 0.7000 |
| PLANNED TEST TIME                                   | 0.0335  | 0.0335  | 0.0335  | 0.0335 | 0.0144 | 0.0144 | 0.0144 | 0.0144 |
| MODEL ESTIMATE                                      | 7.6158  | 6.3159  | 4.7355  | 2.2234 | 3.9157 | 2.8907 | 2.7125 | 2.4690 |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 2439.53 | 2076.63 | 1478.51 | 641.14 | 459.93 | 307.18 | 287.70 | 252.14 |
| SAMPLE STD DEVIATION                                | 5.4515  | 9.0550  | 7.3556  | 2.0223 | 6.6442 | 3.2814 | 5.0178 | 2.7750 |
| CUMULATIVE TEST TIME                                | 0.333   | 0.666   | 0.999   | 1.331  | 1.474  | 1.617  | 1.760  | 1.903  |
| CUMULATIVE FAILURES                                 | 0.1200  | 0.2700  | 0.3900  | 0.5300 | 0.6600 | 0.7700 | 0.8100 | 0.9300 |

| PHASE   | 9      | 10     | 11     | 12     | 13     | 14     | 15     | 16     |
|---|--------|--------|--------|--------|--------|--------|--------|--------|
| ACTUAL FAILURE RATE                                 | 0.4000 | 0.4000 | 0.4000 | 0.4000 | 0.0500 | 0.0500 | 0.0500 | 0.0500 |
| PLANNED TEST TIME                                   | 0.0251 | 0.0251 | 0.0251 | 0.0251 | 0.2010 | 0.2010 | 0.2010 | 0.2010 |
| MODEL ESTIMATE                                      | 2.4416 | 2.3881 | 2.2541 | 1.5479 | 0.3427 | 0.2402 | 0.2059 | 0.1389 |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 510.39 | 497.02 | 463.02 | 286.95 | 98.20  | 314.39 | 219.88 | 176.94 |
| SAMPLE STD DEVIATION                                | 5.5000 | 5.7101 | 5.0000 | 2.5013 | 0.7600 | 0.2270 | 0.2459 | 0.1447 |
| CUMULATIVE TEST TIME                                | 2.153  | 2.403  | 2.653  | 2.903  | 4.906  | 6.903  | 8.906  | 10.906 |
| CUMULATIVE FAILURES                                 | 1.0200 | 1.1700 | 1.2400 | 1.3300 | 1.3900 | 1.5600 | 1.6900 | 1.7700 |

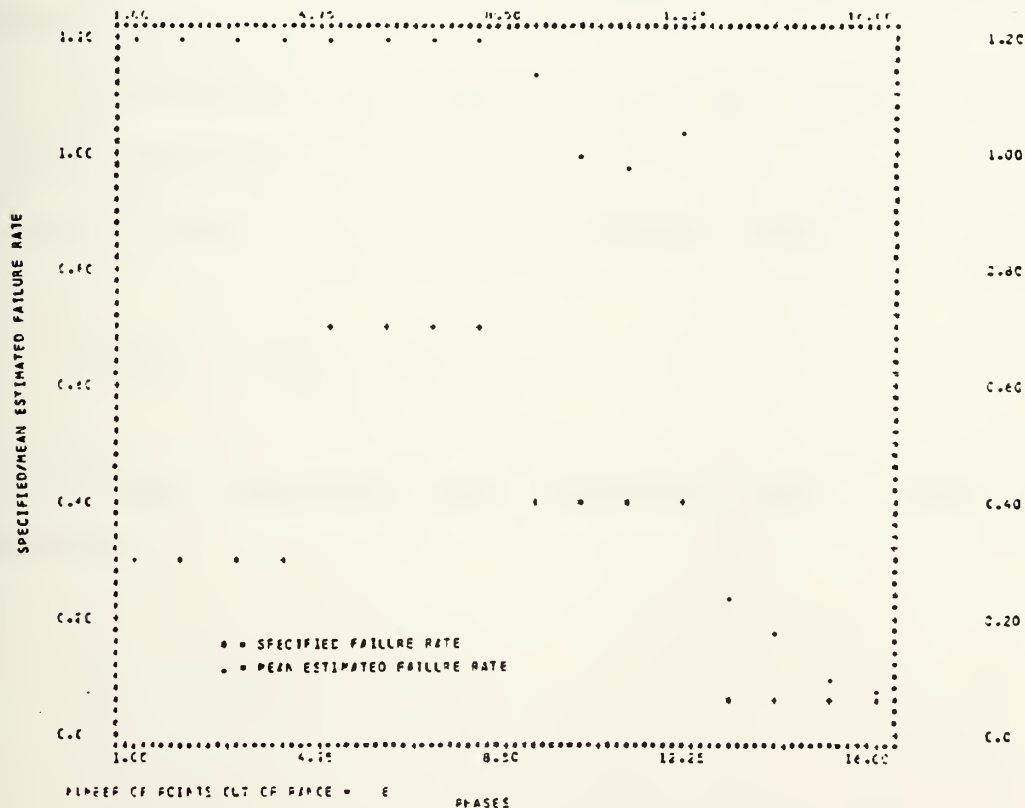






| PHASE   | 1       | 2      | 3      | 4      | 5      | 6      | 7      | 8      |
|---|---------|--------|--------|--------|--------|--------|--------|--------|
| ACTUAL FAILURE RATE                                 | 0.3000  | 0.3000 | 0.3000 | 0.3000 | 0.7000 | 0.7000 | 0.7000 | 0.7000 |
| PLANNED TEST TIME                                   | 0.0335  | 0.0335 | 0.0335 | 0.0335 | 0.0144 | 0.0144 | 0.0144 | 0.0144 |
| MCCREL ESTIMATE                                     | 3.5627  | 1.9091 | 1.8587 | 1.3946 | 2.5276 | 2.7251 | 1.5564 | 1.7045 |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 1027.50 | 535.02 | 519.55 | 364.86 | 261.05 | 265.30 | 128.06 | 143.51 |
| SAMPLE STC DEVIATION                                | 6.7221  | 2.1145 | 2.3548 | 1.8112 | 5.3355 | 7.5045 | 2.0276 | 2.5603 |
| CUMULATIVE TEST TIME                                | 0.666   | 1.334  | 2.000  | 2.666  | 2.952  | 2.227  | 2.523  | 3.809  |
| CUMULATIVE FAILURES                                 | 0.1500  | 0.3000 | 0.6100 | 0.8200 | 1.0200 | 1.2500 | 1.4400 | 1.6200 |

| PHASE   | 9      | 10     | 11     | 12     | 13     | 14     | 15     | 16     |
|---|--------|--------|--------|--------|--------|--------|--------|--------|
| ACTUAL FAILURE RATE                                 | 0.4000 | 0.4000 | 0.4000 | 0.4000 | 0.0500 | 0.0500 | 0.0500 | 0.0500 |
| PLANNED TEST TIME                                   | 0.0251 | 0.0251 | 0.0251 | 0.0251 | 0.2010 | 0.2010 | 0.2010 | 0.2010 |
| MCCREL ESTIMATE                                     | 1.1466 | 0.5597 | 0.9717 | 1.0478 | 0.2340 | 0.1723 | 0.1066 | 0.0826 |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 166.66 | 145.52 | 142.94 | 161.95 | 366.07 | 244.55 | 117.15 | 67.56  |
| SAMPLE STC DEVIATION                                | 1.3000 | 0.9304 | 1.2512 | 2.2305 | 0.1603 | 0.2556 | 0.0770 | 0.0511 |
| CUMULATIVE TEST TIME                                | 4.305  | 4.805  | 5.205  | 5.809  | 5.816  | 13.812 | 17.875 | 21.877 |
| CUMULATIVE FAILURES                                 | 1.8000 | 2.0400 | 2.2600 | 2.4000 | 2.5300 | 2.7700 | 2.8600 | 2.9500 |





## APPENDIX C

### Results of Test MOD1

#### 1. Test MOD1

Test MOD1 used the AMSAA model to estimate the failure rate of the items tested except as described below. A more detailed discussion of the modification can be found in Section V-D.

Use of the AMSAA model was modified as follows:

a. The point estimate of the failure rate,

$$r_p = \frac{\text{number of failures during a phase}}{\text{total test time during a phase}},$$

was used whenever cumulative test time over all items was less than 10 hours.

b. The slope of the reliability growth pattern was estimated using the current point estimator,  $r_p$ , and the previous estimate,  $\hat{r}_{i-1}$ , of the failure rate as follows:

$$\text{SLOPE} = r_p - \hat{r}_{i-1} .$$

Increasing slope was then determined from the following relationship:

$$r_p - \hat{r}_{i-1} \geq .07 .$$



If the slope was increasing, the point estimate,  $r_D$ , was used as the current estimate of the failure rate. Then, the AMSAA model was reinitialized, that is, time and failures prior to an increasing slope were not considered in future estimates made by the model.

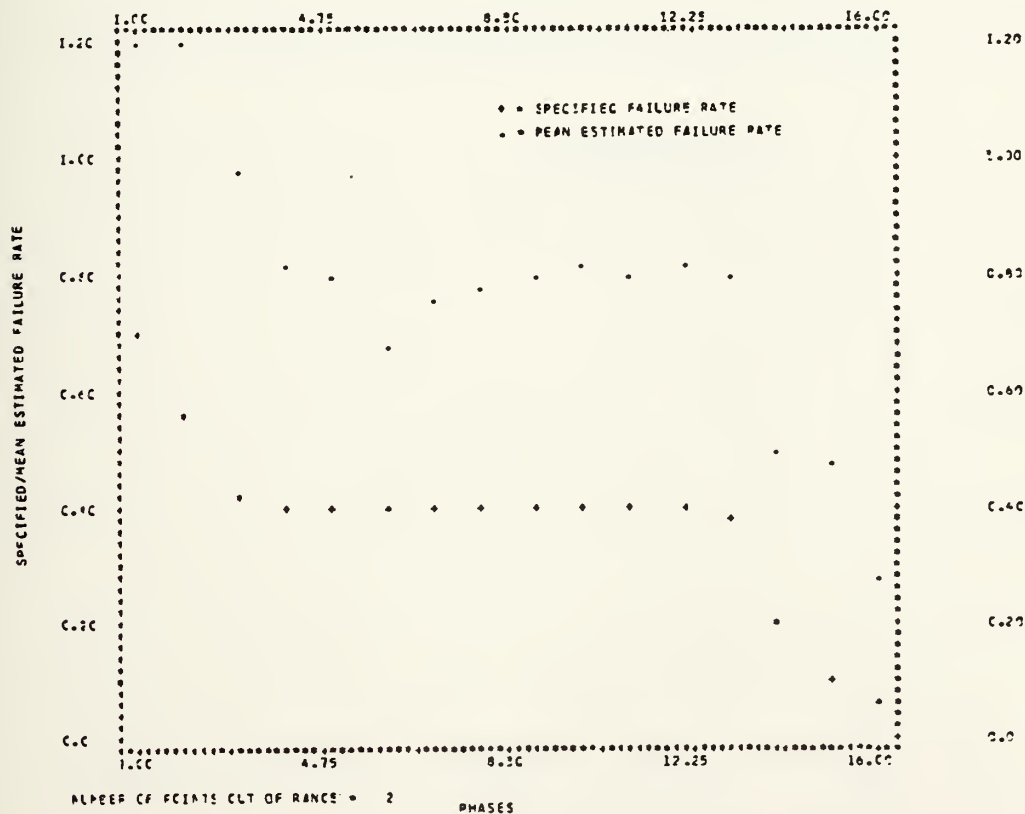
## 2. The Results

Results for Cases 4, 6, 15, and 18 are presented here as representative of the effect the modifications had on the performance of the model. A detailed description of the format of the results can be found in Appendix A.



| PHASE   | 1      | 2      | 3      | 4      | 5      | 6      | 7      | 8      |
|---|--------|--------|--------|--------|--------|--------|--------|--------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.5500 | 0.4250 | 0.4050 | 0.4000 | 0.4000 | 0.4000 | 0.4000 |
| PLANNED TEST TIME                                   | 0.2222 | 0.2599 | 0.3024 | 0.4013 | 0.4063 | 0.4063 | 0.4063 | 0.4063 |
| MODEL ESTIMATE                                      | 1.3450 | 1.2900 | 0.9888 | 0.8159 | 0.8067 | 0.6794 | 0.7687 | 0.7797 |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 92.15  | 134.54 | 132.65 | 101.47 | 101.66 | 65.84  | 52.17  | 93.93  |
| SAMPLE STD DEVIATION                                | 0.6735 | 0.7356 | 0.6517 | 0.4587 | 0.4655 | 0.5281 | 0.4922 | 0.5609 |
| CUMULATIVE TEST TIME                                | 1.074  | 2.418  | 4.202  | 6.049  | 7.942  | 9.843  | 11.657 | 13.980 |
| CUMULATIVE FAILURES                                 | 0.6400 | 1.5100 | 2.0700 | 2.8900 | 3.9900 | 4.1700 | 4.9900 | 5.6900 |

| PHASE   | 9      | 10     | 11     | 12     | 13     | 14      | 15      | 16      |
|---|--------|--------|--------|--------|--------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.4000 | 0.4000 | 0.4000 | 0.4000 | 0.3750 | 0.2000  | 0.1000  | 0.0500  |
| PLANNED TEST TIME                                   | 0.4063 | 0.4063 | 0.4063 | 0.4063 | 0.4334 | 0.8126  | 1.6227  | 3.7904  |
| MODEL ESTIMATE                                      | 0.8016 | 0.8147 | 0.7922 | 0.8142 | 0.7981 | 0.4575  | 0.4810  | 0.2830  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 100.41 | 103.67 | 98.05  | 103.55 | 112.63 | 146.76  | 360.97  | 465.62  |
| SAMPLE STD DEVIATION                                | 0.5055 | 0.4976 | 0.4452 | 0.7469 | 0.7561 | 0.4299  | 1.5370  | 1.0418  |
| CUMULATIVE TEST TIME                                | 19.442 | 17.219 | 19.166 | 21.049 | 23.079 | 26.860  | 34.326  | 49.304  |
| CUMULATIVE FAILURES                                 | 6.4400 | 7.1500 | 7.7800 | 8.2700 | 9.0800 | 10.0000 | 10.5600 | 11.6400 |

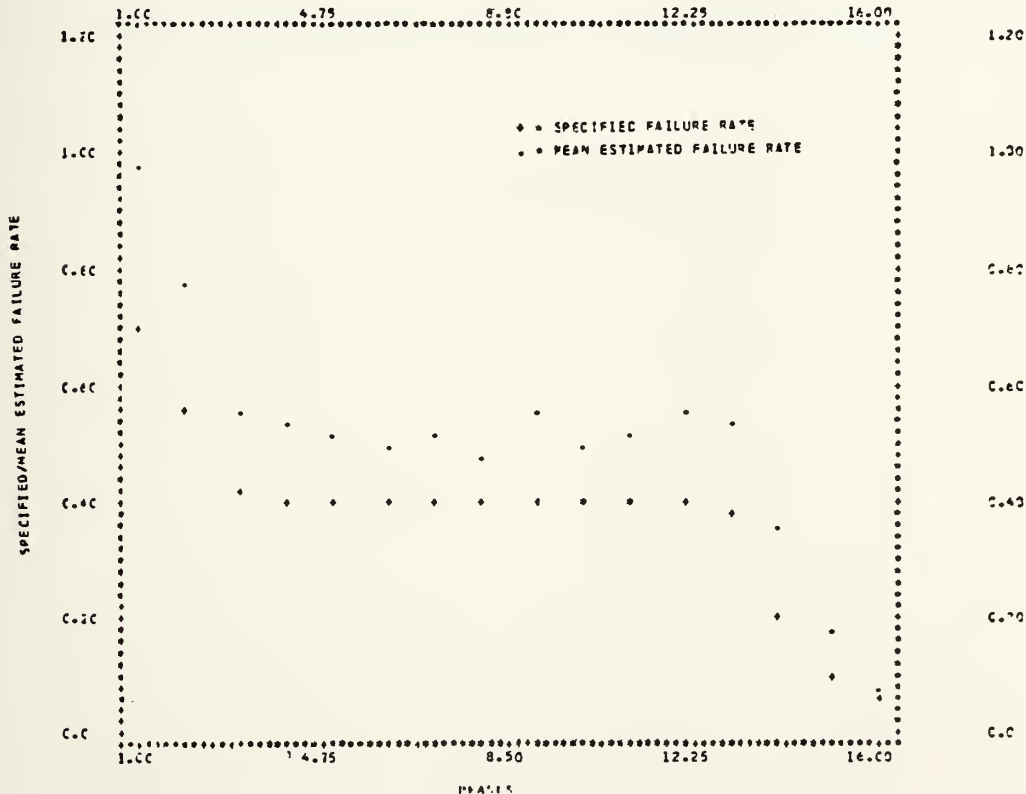






| PHASE   | 1      | 2      | 3      | 4      | 5      | 6      | 7       | 8       |
|---|--------|--------|--------|--------|--------|--------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.5500 | 0.4250 | 0.4050 | 0.4000 | 0.4000 | 0.4000  | 0.4000  |
| PLANNED TEST TIME                                   | 0.2322 | 0.2955 | 0.3824 | 0.4013 | 0.4063 | 0.4063 | 0.4063  | 0.4063  |
| MCEEL ESTIMATE                                      | 0.9739 | 0.7761 | 0.5674 | 0.5329 | 0.5258 | 0.5026 | 0.5283  | 0.4779  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 39.13  | 41.11  | 33.50  | 31.58  | 31.45  | 25.65  | 32.08   | 19.78   |
| SAMPLE STD DEVIATION                                | 0.6085 | 0.5434 | 0.3315 | 0.3378 | 0.2656 | 0.3714 | 0.2459  | 0.2967  |
| CUMPLATIVE TEST TIME                                | 2.136  | 4.887  | 8.462  | 12.133 | 19.882 | 19.623 | 23.410  | 27.199  |
| CUMPLATIVE FAILURES                                 | 1.5400 | 2.9400 | 4.1400 | 5.8000 | 7.1600 | 8.4500 | 10.9000 | 15.4000 |

| PHASE   | 9       | 10      | 11      | 12      | 13      | 14      | 15      | 16      |
|---|---------|---------|---------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.4000  | 0.4000  | 0.4000  | 0.4000  | 0.3750  | 0.2000  | 0.1000  | 0.0500  |
| PLANNED TEST TIME                                   | 0.4063  | 0.4063  | 0.4063  | 0.4063  | 0.4334  | 0.8126  | 1.6252  | 3.2504  |
| MCEEL ESTIMATE                                      | 0.5674  | 0.4926  | 0.5256  | 0.5553  | 0.5457  | 0.3559  | 0.1863  | 0.0658  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 41.84   | 23.15   | 31.40   | 38.83   | 45.53   | 77.54   | 66.25   | 71.55   |
| SAMPLE STD DEVIATION                                | 0.3480  | 0.3131  | 0.3157  | 0.2990  | 0.3676  | 0.2904  | 0.1443  | 0.0559  |
| CUMPLATIVE TEST TIME                                | 30.943  | 34.723  | 38.459  | 42.187  | 46.178  | 53.627  | 68.585  | 98.301  |
| CUMPLATIVE FAILURES                                 | 12.9700 | 14.4500 | 16.0100 | 17.2200 | 18.6900 | 20.5800 | 22.1900 | 23.9300 |



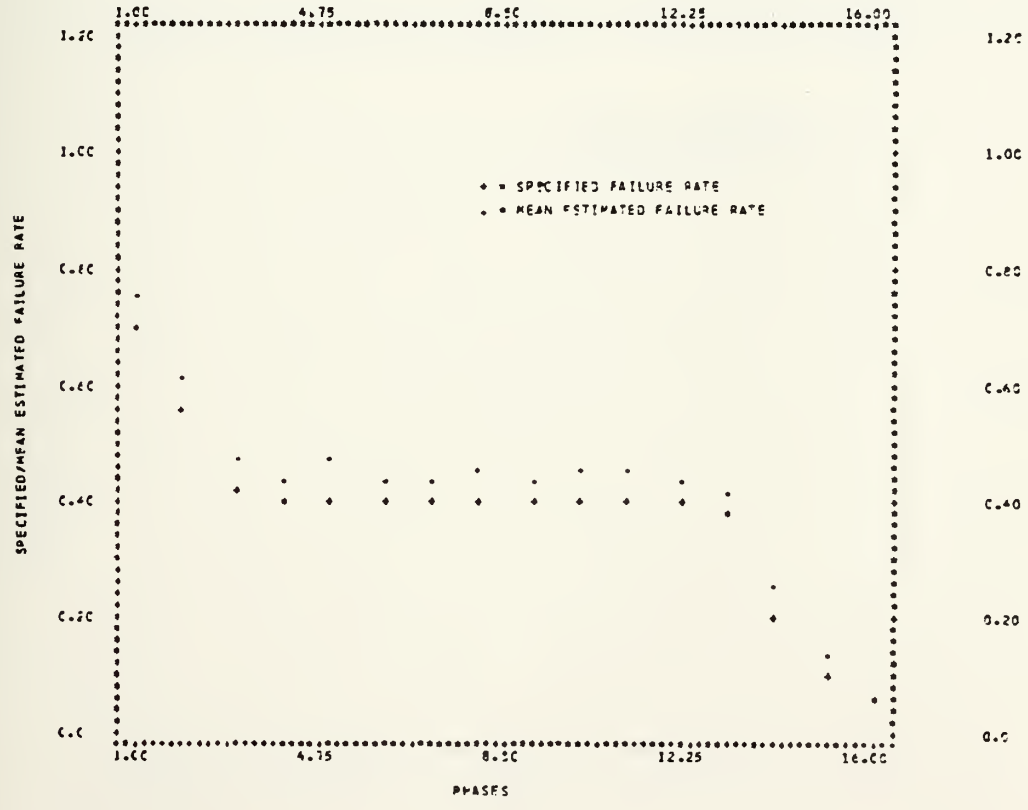


CASE 4

20 ITEMS

| PHASE   | 1      | 2      | 3      | 4       | 5       | 6       | 7       | 8       |
|---|--------|--------|--------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.5500 | 0.4250 | 0.4050  | 0.4000  | 0.4000  | 0.4000  | 0.4000  |
| PLANNED TEST TIME                                   | 0.2322 | 0.2555 | 0.3824 | 0.4013  | 0.4063  | 0.4063  | 0.4063  | 0.4063  |
| MCCEL ESTIMATE                                      | 0.7576 | 0.6155 | 0.4855 | 0.4428  | 0.4775  | 0.4449  | 0.4455  | 0.4675  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 8.23   | 12.63  | 14.22  | 9.33    | 19.35   | 11.22   | 11.38   | 16.58   |
| SAMPLE STD DEVIATION                                | 0.4180 | 0.3404 | 0.2597 | 0.2565  | 0.3132  | 0.2414  | 0.2069  | 0.2144  |
| CUMPLATIVE TEST TIME                                | 4.313  | 9.758  | 16.874 | 24.303  | 31.758  | 35.327  | 46.759  | 54.166  |
| CUMPLATIVE FAILURES                                 | 2.9500 | 5.8600 | 8.8100 | 11.7100 | 14.7100 | 17.6100 | 20.6300 | 23.5900 |

| PHASE   | 9       | 10      | 11      | 12      | 13      | 14      | 15      | 16      |
|---|---------|---------|---------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.4000  | 0.4000  | 0.4000  | 0.4000  | 0.3750  | 0.2000  | 0.1000  | 0.0500  |
| PLANNED TEST TIME                                   | 0.4063  | 0.4063  | 0.4063  | 0.4063  | 0.4334  | 0.8126  | 1.6352  | 3.2504  |
| MCCEL ESTIMATE                                      | 0.4416  | 0.4674  | 0.4527  | 0.4400  | 0.4221  | 0.2574  | 0.1408  | 0.0665  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 10.40   | 16.85   | 13.17   | 10.00   | 12.55   | 28.71   | 40.63   | 36.92   |
| SAMPLE STD DEVIATION                                | 0.2000  | 0.2363  | 0.2373  | 0.2154  | 0.2216  | 0.1574  | 0.0957  | 0.0787  |
| CUMPLATIVE TEST TIME                                | 61.676  | 69.133  | 76.672  | 84.172  | 92.154  | 107.154 | 137.320 | 197.432 |
| CUMPLATIVE FAILURES                                 | 27.0400 | 30.2200 | 32.8500 | 36.1700 | 39.6600 | 42.0600 | 44.8000 | 47.8000 |



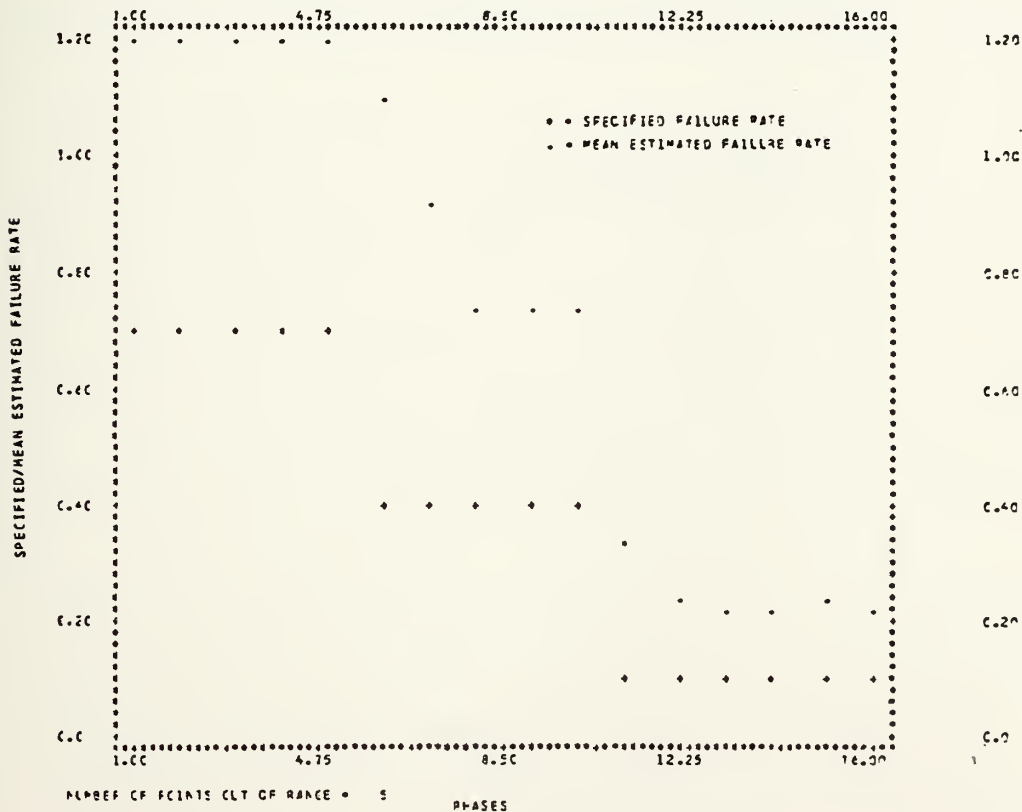


CASE 6

5 ITEMS

| PHASE   | 1      | 2      | 3      | 4      | 5      | 6      | 7      | 8      |
|---|--------|--------|--------|--------|--------|--------|--------|--------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.7000 | 0.7000 | 0.7000 | 0.7000 | 0.4000 | 0.4000 | 0.4000 |
| PLANNED TEST TIME                                   | 0.2322 | 0.2322 | 0.2322 | 0.2322 | 0.2322 | 0.4063 | 0.4063 | 0.4063 |
| MODEL ESTIMATE                                      | 1.3652 | 1.4414 | 1.3780 | 1.4248 | 1.3628 | 1.0920 | 0.9198 | 0.7451 |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 95.03  | 105.91 | 96.85  | 103.54 | 94.68  | 172.95 | 129.44 | 96.27  |
| SAMPLE STD DEVIATION                                | 0.6434 | 0.8539 | 0.7429 | 0.7812 | 0.6953 | 0.7158 | 0.6374 | 0.5886 |
| CUMULATIVE TEST TIME                                | 1.061  | 2.128  | 3.205  | 4.305  | 5.374  | 7.210  | 9.075  | 10.968 |
| CUMULATIVE FAILURES                                 | 0.7400 | 1.4500 | 2.2000 | 2.8400 | 3.4700 | 4.3300 | 4.9700 | 5.5500 |

| PHASE   | 9      | 10     | 11     | 12     | 13     | 14      | 15      | 16      |
|---|--------|--------|--------|--------|--------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.4000 | 0.4000 | 0.1000 | 0.1000 | 0.1000 | 0.1000  | 0.1000  | 0.1000  |
| PLANNED TEST TIME                                   | 0.4063 | 0.4063 | 1.6252 | 1.6252 | 1.6252 | 1.6252  | 1.6252  | 1.6252  |
| MODEL ESTIMATE                                      | 0.7355 | 0.7320 | 0.3303 | 0.2486 | 0.2230 | 0.2152  | 0.2373  | 0.2224  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 83.89  | 82.01  | 230.34 | 148.63 | 123.04 | 115.18  | 137.33  | 122.42  |
| SAMPLE STD DEVIATION                                | 0.5162 | 0.5221 | 0.4434 | 0.2996 | 0.2061 | 0.1708  | 0.3124  | 0.1600  |
| CUMULATIVE TEST TIME                                | 12.856 | 14.742 | 22.241 | 25.722 | 37.201 | 44.676  | 52.044  | 59.923  |
| CUMULATIVE FAILURES                                 | 6.6000 | 6.9200 | 7.7400 | 8.7300 | 9.6300 | 10.1900 | 10.8500 | 11.5000 |



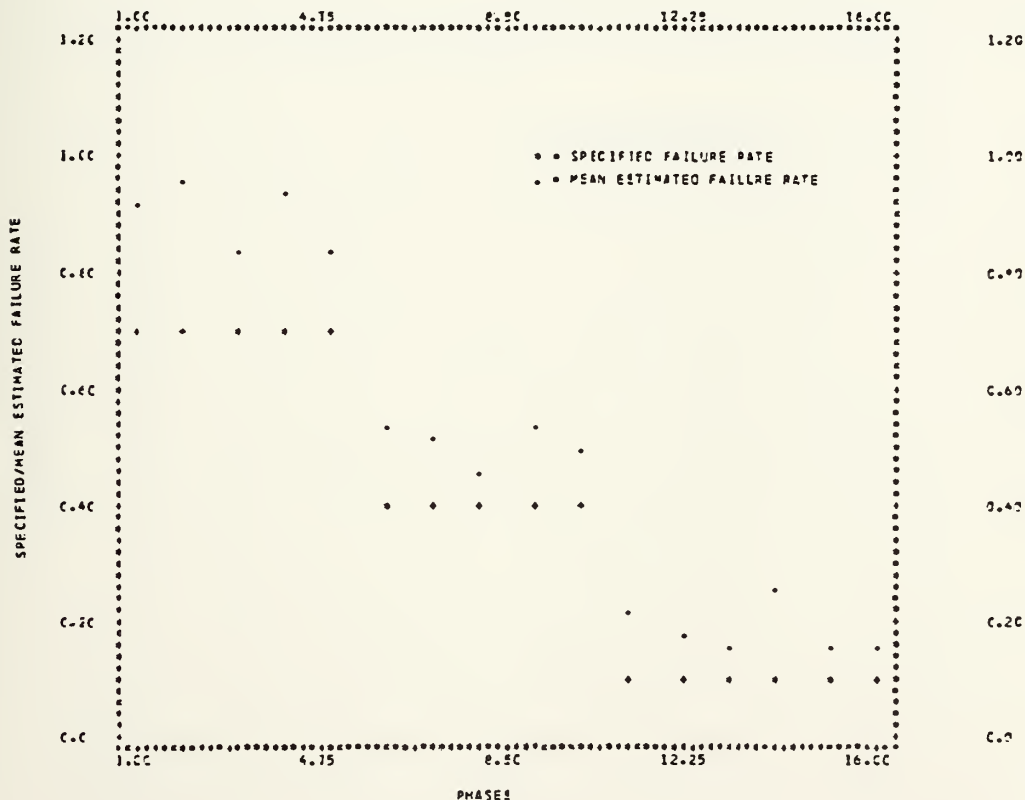


CASE 4

10 ITEMS

| PHASE   | 1      | 2      | 3      | 4      | 5      | 6      | 7      | 8       |
|---|--------|--------|--------|--------|--------|--------|--------|---------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.7000 | 0.7000 | 0.7000 | 0.7000 | 0.4000 | 0.4000 | 0.4000  |
| PLANNED TEST TIME                                   | 0.2322 | 0.2322 | 0.2322 | 0.2322 | 0.2322 | 0.4063 | 0.4063 | 0.4063  |
| POCEL ESTIMATE                                      | 0.9192 | 0.6590 | 0.8404 | 0.5337 | 0.6456 | 0.5467 | 0.5256 | 0.4666  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 31.32  | 37.00  | 20.05  | 33.38  | 21.37  | 36.67  | 21.41  | 16.69   |
| SAMPLE STD DEVIATION                                | 0.5075 | 0.5522 | 0.4066 | 0.4841 | 0.5002 | 0.4415 | 0.4015 | 0.2753  |
| CUMULATIVE TEST TIME                                | 2.158  | 4.277  | 6.441  | 8.553  | 10.725 | 14.499 | 18.287 | 22.053  |
| CUMULATIVE FAILURES                                 | 1.3500 | 3.0100 | 4.3100 | 5.9200 | 7.0600 | 8.6600 | 9.9800 | 11.1700 |

| PHASE   | 9       | 10      | 11      | 12      | 13      | 14      | 15      | 16      |
|---|---------|---------|---------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.4000  | 0.4000  | 0.1000  | 0.1000  | 0.1000  | 0.1000  | 0.1000  | 0.1000  |
| PLANNED TEST TIME                                   | 0.4063  | 0.4063  | 1.6252  | 1.6252  | 1.6252  | 1.6252  | 1.6252  | 1.6252  |
| POCEL ESTIMATE                                      | 0.5485  | 0.5073  | 0.2168  | 0.1753  | 0.1545  | 0.2546  | 0.1333  | 0.1678  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 37.22   | 26.82   | 116.84  | 75.27   | 54.54   | 154.56  | 55.32   | 67.82   |
| SAMPLE STD DEVIATION                                | 0.3280  | 0.3046  | 0.2033  | 0.1891  | 0.1187  | 1.0256  | 0.0539  | 0.1485  |
| CUMULATIVE TEST TIME                                | 25.831  | 29.565  | 44.552  | 55.418  | 74.438  | 85.320  | 104.331 | 119.304 |
| CUMULATIVE FAILURES                                 | 12.7500 | 14.0300 | 15.3500 | 17.4500 | 19.0200 | 20.5800 | 22.1800 | 23.2600 |



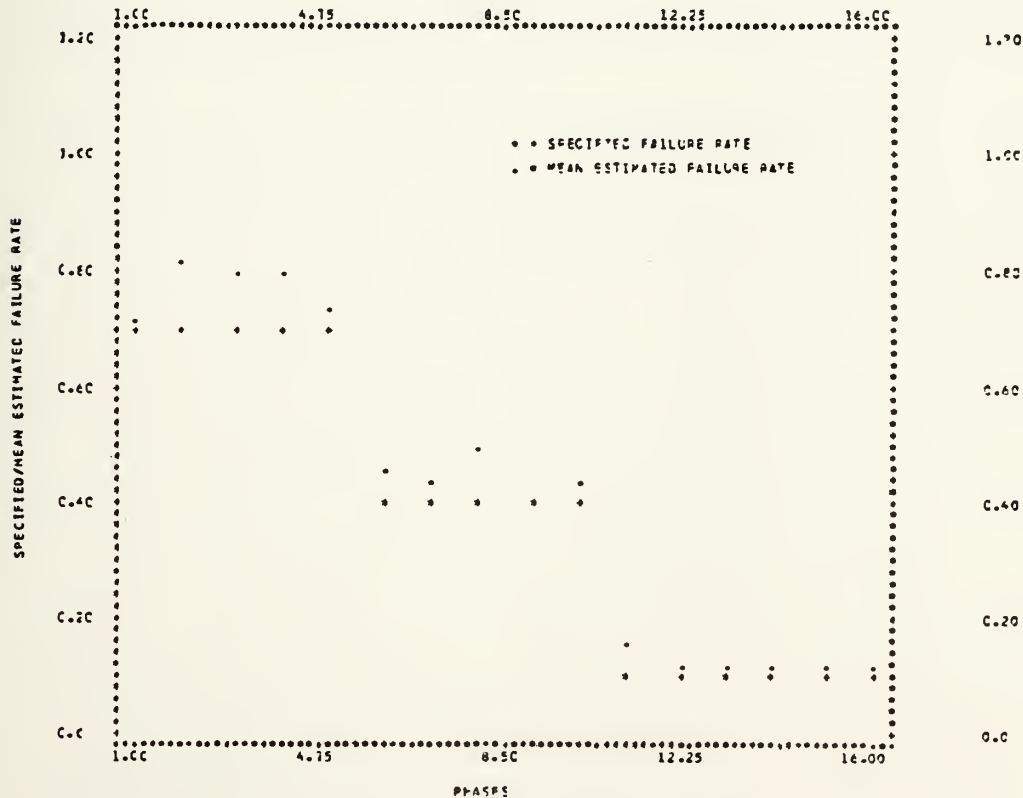




| PHASE   | 1      | 2      | 3      | 4       | 5       | 6       | 7       | 8       |
|---|--------|--------|--------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.7000 | 0.7000 | 0.7000  | 0.7000  | 0.4000  | 0.4000  | 0.4000  |
| PLANNED TEST TIME                                   | 0.2322 | 0.2322 | 0.2322 | 0.2322  | 0.2322  | 0.4063  | 0.4063  | 0.4063  |
| MODEL ESTIMATE                                      | 0.7251 | 0.6111 | 0.7970 | 0.7949  | 0.7356  | 0.4506  | 0.4465  | 0.4928  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 3.28   | 15.66  | 13.86  | 13.56   | 5.11    | 12.64   | 12.24   | 23.21   |
| SAMPLE STD DEVIATION                                | 0.4087 | 0.4101 | 0.3854 | 0.3754  | 0.4263  | 0.2427  | 0.1866  | 0.2416  |
| CUMULATIVE TEST TIME                                | 4.294  | 8.561  | 12.842 | 17.130  | 21.415  | 28.502  | 36.410  | 43.831  |
| CUMULATIVE FAILURES                                 | 2.7700 | 6.0500 | 9.2000 | 12.3000 | 15.2100 | 18.0700 | 21.0200 | 24.3000 |

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| PHASE   | 9       | 10      | 11      | 12      | 13      | 14      | 15      | 16      |
|---|---------|---------|---------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.4000  | 0.4000  | 0.1000  | 0.1000  | 0.1000  | 0.1000  | 0.1000  | 0.1000  |
| PLANNED TEST TIME                                   | 0.4063  | 0.4063  | 1.6252  | 1.6252  | 1.6252  | 1.6252  | 1.6252  | 1.6252  |
| MODEL ESTIMATE                                      | 0.4087  | 0.4423  | 0.1678  | 0.1266  | 0.1151  | 0.1188  | 0.1273  | 0.1224  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 2.17    | 10.58   | 67.83   | 26.62   | 15.06   | 16.74   | 27.28   | 22.40   |
| SAMPLE STD DEVIATION                                | 0.2044  | 0.2269  | 0.1802  | 0.0588  | 0.0479  | 0.0775  | 0.0554  | 0.0608  |
| CUMULATIVE TEST TIME                                | 51.373  | 58.856  | 88.618  | 118.487 | 148.455 | 178.515 | 208.245 | 238.637 |
| CUMULATIVE FAILURES                                 | 27.0300 | 30.0600 | 33.1700 | 34.4600 | 35.4300 | 41.9700 | 45.2600 | 48.2700 |

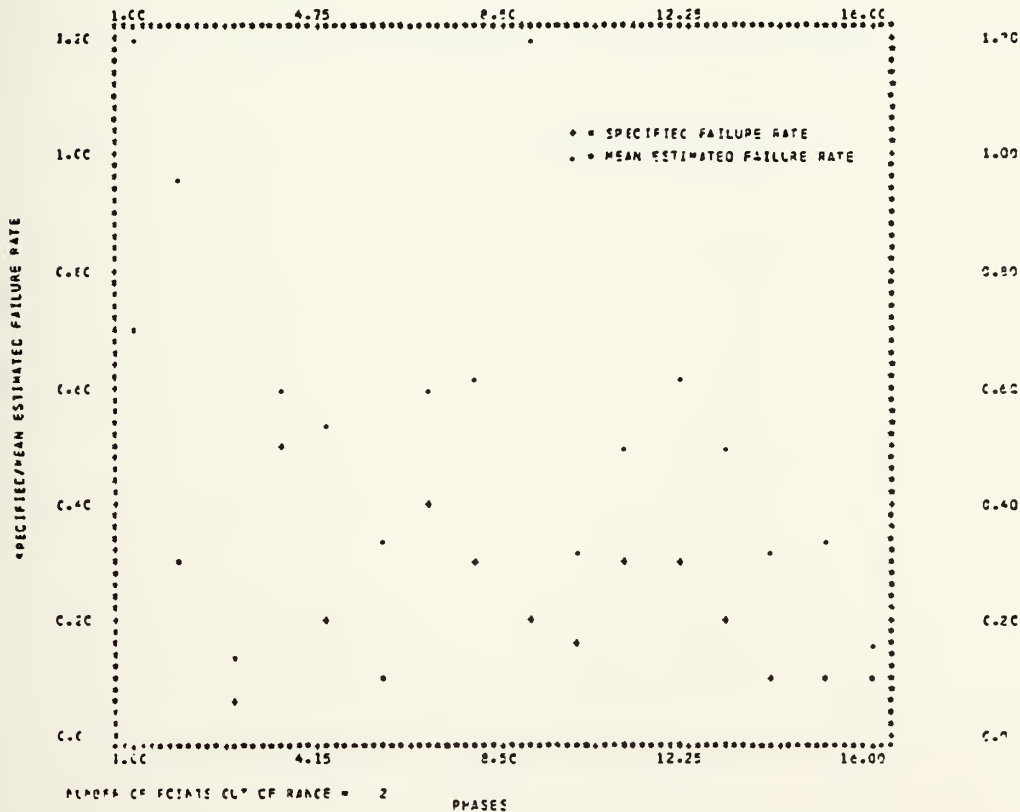




5 ITEMS

| PHASE   | 1      | 2      | 3      | 4      | 5      | 6      | 7      | 9      |
|---|--------|--------|--------|--------|--------|--------|--------|--------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.3000 | 0.0500 | 0.5000 | 0.2000 | 0.1000 | 0.4000 | 0.3000 |
| PLANNED TEST TIME                                   | 0.2322 | 0.5417 | 3.2504 | 0.3250 | 0.8126 | 1.6252 | 0.4063 | 0.9417 |
| MCCEL ESTIMATE                                      | 1.5230 | 0.9539 | 0.1409 | 0.6078 | 0.5407 | 0.3337 | 0.5952 | 0.6176 |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 117.57 | 217.57 | 181.70 | 21.55  | 170.34 | 232.72 | 49.79  | 109.86 |
| SAMPLE STD DEVIATION                                | 1.0093 | 0.8239 | 0.2124 | 0.5533 | 0.4577 | 0.2265 | 0.4537 | 0.4566 |
| CUMULATIVE TEST TIME                                | 1.074  | 3.573  | 18.461 | 19.990 | 23.722 | 31.225 | 33.112 | 35.575 |
| CUMULATIVE FAILURES                                 | 0.7500 | 1.5200 | 2.1600 | 2.5500 | 3.9300 | 4.2700 | 4.9600 | 5.6400 |

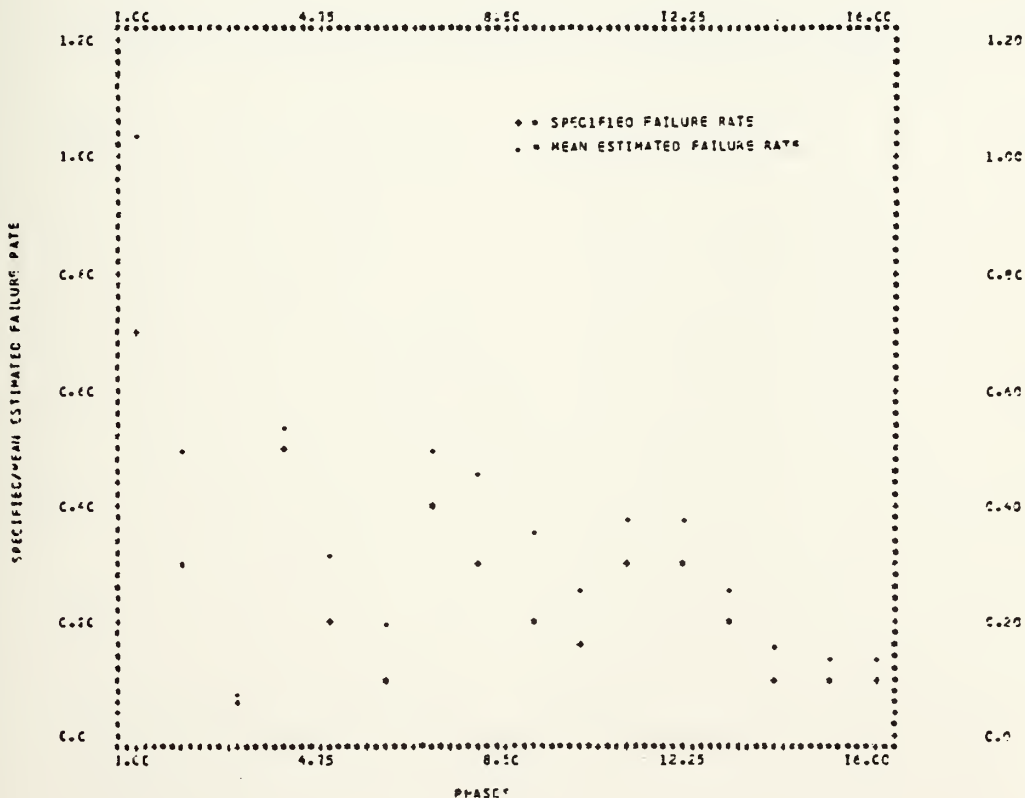
| PHASE   | 9       | 10     | 11     | 12     | 13     | 14      | 15      | 16      |
|---|---------|--------|--------|--------|--------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.2000  | 0.1500 | 0.3000 | 0.3000 | 0.2000 | 0.1000  | 0.1000  | 0.1000  |
| PLANNED TEST TIME                                   | 0.8126  | 1.0825 | 0.5417 | 0.5417 | 0.8126 | 1.6252  | 1.6252  | 1.6252  |
| MCCEL ESTIMATE                                      | 2.4787  | 0.3198 | 0.4945 | 0.6131 | 0.5051 | 0.3279  | 0.3391  | 0.1680  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 1139.34 | 113.20 | 64.82  | 104.37 | 152.53 | 227.68  | 239.14  | 66.07   |
| SAMPLE STD DEVIATION                                | 19.8375 | 0.2624 | 0.3734 | 0.3696 | 0.3243 | 0.5730  | 1.2141  | 0.1567  |
| CUMULATIVE TEST TIME                                | 39.351  | 44.288 | 46.766 | 49.254 | 52.005 | 60.464  | 66.097  | 75.779  |
| CUMULATIVE FAILURES                                 | 6.5500  | 7.3600 | 8.3100 | 8.7000 | 9.5700 | 10.2500 | 11.0700 | 11.7200 |





| PHASE   | 1      | 2      | 3      | 4      | 5      | 6      | 7       | 8       |
|---|--------|--------|--------|--------|--------|--------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.3000 | 0.0500 | 0.0000 | 0.2000 | 0.1000 | 0.4000  | 0.7000  |
| PLANNED TEST TIME                                   | 0.2322 | 0.3417 | 3.2504 | 0.3250 | 0.6126 | 1.6252 | 0.4003  | 0.2417  |
| MCCEL ESTIMATE                                      | 1.0352 | 0.5081 | 0.0731 | 0.5402 | 0.3202 | 0.2040 | 0.5040  | 0.4673  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 48.46  | 65.36  | 46.26  | 8.05   | 60.05  | 103.55 | 25.55   | 55.77   |
| SAMPLE STD DEVIATION                                | 0.5388 | 0.3629 | 0.0726 | 0.4624 | 0.2796 | 0.2326 | 0.3755  | 0.2766  |
| CUMULATIVE TEST TIME                                | 2.104  | 7.063  | 37.101 | 40.105 | 47.606 | 62.576 | 66.304  | 71.262  |
| CUMULATIVE FAILURES                                 | 1.7700 | 3.3500 | 4.8500 | 6.3000 | 7.8200 | 9.2700 | 10.5800 | 12.4700 |

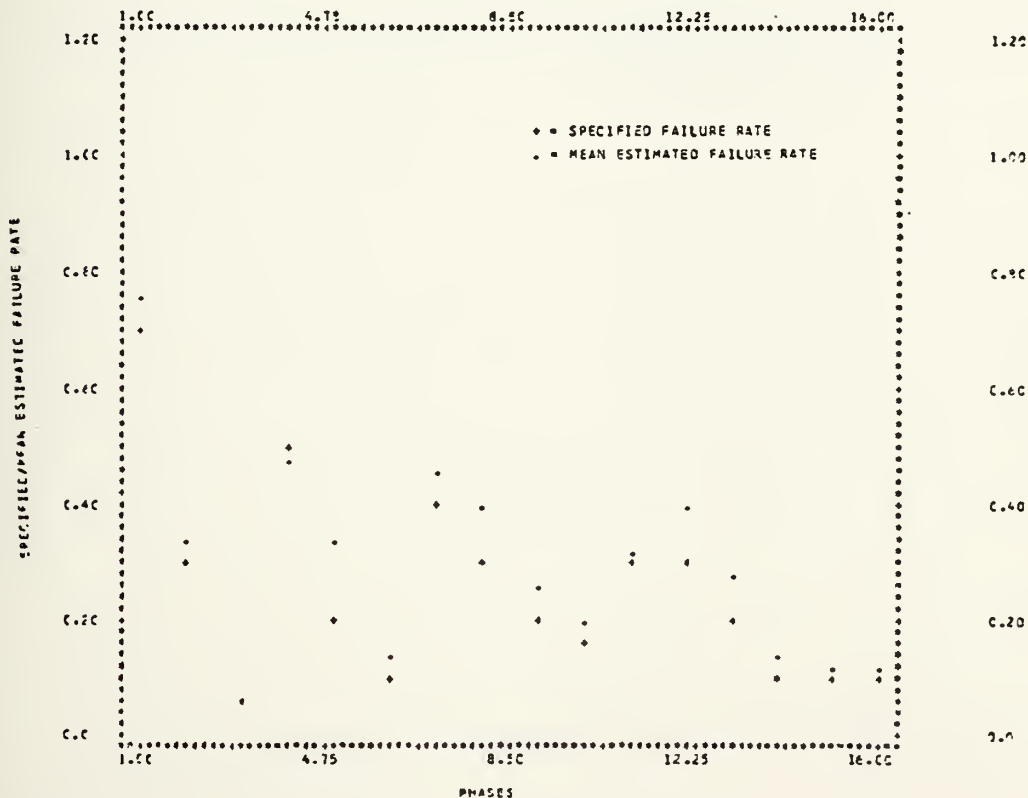
| PHASE   | 9       | 10      | 11      | 12      | 13      | 14      | 15      | 16      |
|---|---------|---------|---------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.2000  | 0.1500  | 0.3000  | 0.3000  | 0.2000  | 0.1000  | 0.1000  | 0.1000  |
| PLANNED TEST TIME                                   | 0.8126  | 1.0035  | 0.5417  | 0.5417  | 0.6126  | 1.6252  | 1.6252  | 1.6252  |
| MCCEL ESTIMATE                                      | 0.3503  | 0.2534  | 0.3880  | 0.3811  | 0.2654  | 0.1652  | 0.1456  | 0.1472  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 75.16   | 66.94   | 29.34   | 27.04   | 34.71   | 65.35   | 45.62   | 45.22   |
| SAMPLE STD DEVIATION                                | 0.3430  | 0.2358  | 0.2636  | 0.2299  | 0.1952  | 0.1152  | 0.1032  | 0.1029  |
| CUMULATIVE TEST TIME                                | 76.786  | 88.725  | 93.707  | 98.702  | 106.248 | 121.305 | 136.297 | 151.192 |
| CUMULATIVE FAILURES                                 | 13.6500 | 15.5700 | 16.8500 | 18.6800 | 19.5200 | 21.4100 | 23.2900 | 24.6700 |





| PHASE   | 1      | 2      | 3      | 4       | 5       | 6       | 7       | 8       |
|---|--------|--------|--------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.3000 | 0.0500 | 0.5000  | 0.2000  | 0.1000  | 0.4000  | 0.7000  |
| PLANNED TEST TIME                                   | 0.2322 | 0.5417 | 3.2504 | 0.3250  | 0.8126  | 1.6252  | 0.4063  | 0.5417  |
| MODEL ESTIMATE                                      | 0.7622 | 0.3412 | 0.0621 | 0.4766  | 0.2480  | 0.1383  | 0.4535  | 0.2518  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 8.89   | 13.75  | 24.25  | 4.68    | 21.5E   | 3E.35   | 13.37   | 30.59   |
| SAMPLE STD DEVIATION                                | 0.4205 | 0.1842 | 0.0376 | 0.3083  | 0.3174  | 0.0E65  | 0.2624  | 0.2677  |
| CUMULATIVE TEST TIME                                | 4.272  | 14.288 | 74.066 | 80.098  | 95.034  | 124.511 | 132.34E | 142.27E |
| CUMULATIVE FAILURES                                 | 2.9500 | 5.8500 | 9.0000 | 11.7600 | 14.7300 | 16.0000 | 21.3200 | 24.4500 |

| PHASE   | 9       | 10      | 11      | 12      | 13      | 14      | 15      | 16      |
|---|---------|---------|---------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.2000  | 0.1500  | 0.3000  | 0.3000  | 0.2000  | 0.1000  | 0.1000  | 0.1000  |
| PLANNED TEST TIME                                   | 0.8126  | 1.0E25  | 0.5417  | 0.5417  | 0.8126  | 1.6252  | 1.6252  | 1.6252  |
| MODEL ESTIMATE                                      | 0.2565  | 0.1541  | 0.3250  | 0.3924  | 0.2753  | 0.1246  | 0.1146  | 0.1242  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 28.23   | 25.40   | 8.34    | 30.80   | 37.66   | 24.95   | 14.28   | 24.24   |
| SAMPLE STD DEVIATION                                | 0.1618  | 0.1076  | 0.1696  | 0.2558  | 0.1836  | 0.0752  | 0.0505  | 0.1080  |
| CUMULATIVE TEST TIME                                | 157.243 | 177.242 | 187.247 | 197.196 | 212.194 | 242.173 | 272.258 | 302.306 |
| CUMULATIVE FAILURES                                 | 27.4000 | 30.4300 | 33.4100 | 36.6600 | 39.6100 | 42.6600 | 45.4900 | 48.4300 |

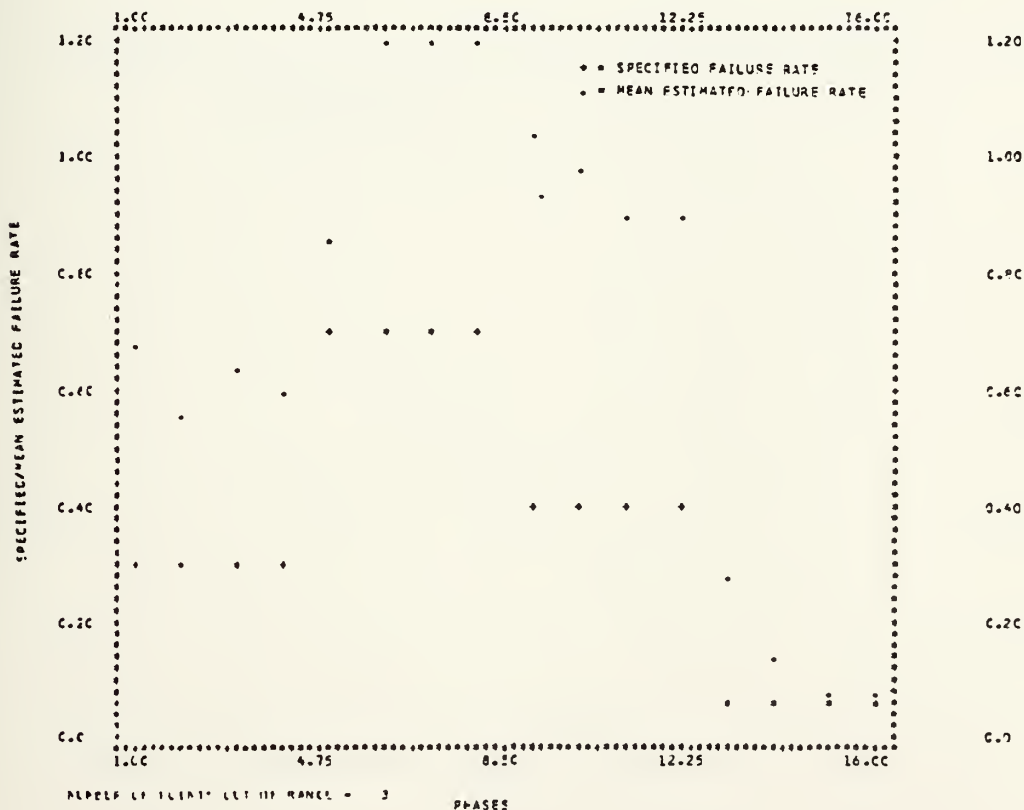






| PHASE   | 1      | 2      | 3      | 4      | 5      | 6      | 7      | 8      |
|---|--------|--------|--------|--------|--------|--------|--------|--------|
| ACTUAL FAILURE RATE                                 | 0.3000 | 0.3000 | 0.3000 | 0.3000 | 0.7000 | 0.7000 | 0.7000 | 0.7000 |
| PLANNED TEST TIME                                   | 0.5417 | 0.5417 | 0.5417 | 0.5417 | 0.2322 | 0.2322 | 0.2322 | 0.2322 |
| MCCEL ESTIMATE                                      | 0.6856 | 0.5667 | 0.6498 | 0.5917 | 0.6700 | 1.2716 | 1.4143 | 1.4726 |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 128.55 | 88.50  | 116.60 | 97.23  | 24.28  | 81.66  | 102.04 | 110.37 |
| SAMPLE STD DEVIATION                                | 0.3824 | 0.3011 | 0.3908 | 0.4396 | 0.7138 | 0.8571 | 0.8568 | 0.8529 |
| CUMULATIVE TEST TIME                                | 2.509  | 5.042  | 7.507  | 10.020 | 11.119 | 12.158 | 13.223 | 14.288 |
| CUMULATIVE FAILURES                                 | 0.7100 | 1.4200 | 2.2100 | 2.7800 | 3.3600 | 4.2700 | 4.8100 | 5.9700 |

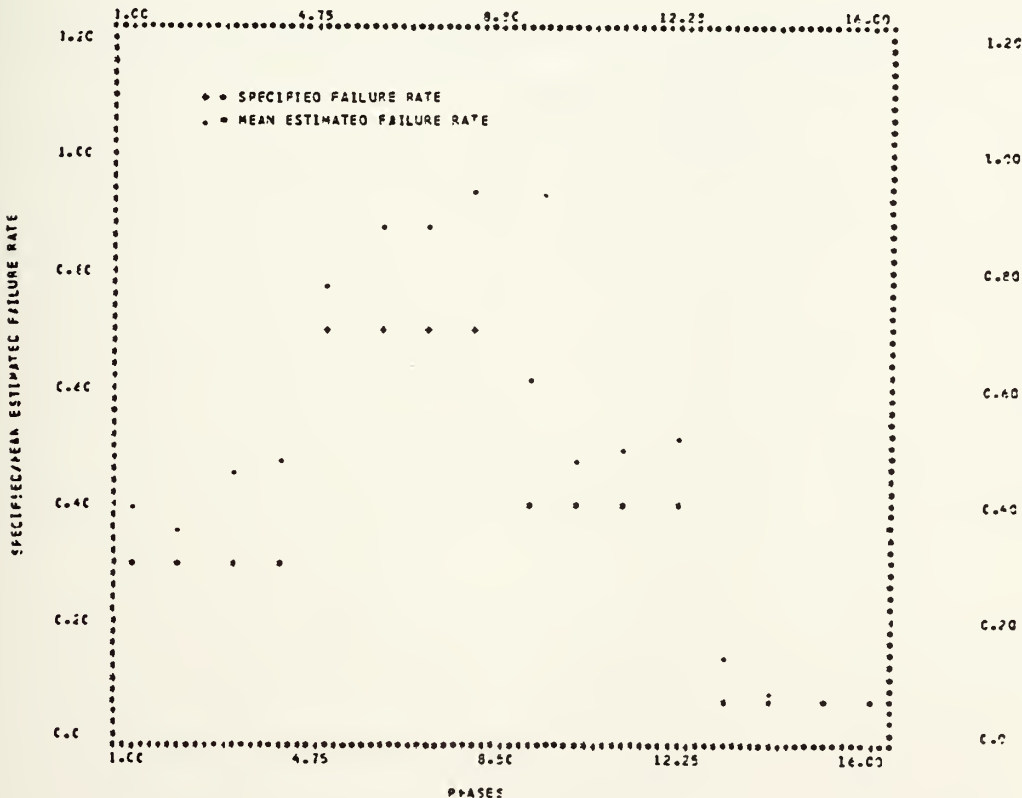
| PHASE   | 9      | 10     | 11     | 12     | 13     | 14      | 15      | 16      |
|---|--------|--------|--------|--------|--------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.4000 | 0.4000 | 0.4000 | 0.4000 | 0.6500 | 0.6500  | 0.6500  | 0.6500  |
| PLANNED TEST TIME                                   | 0.4063 | 0.4063 | 0.4063 | 0.4063 | 2.2504 | 3.2504  | 3.2504  | 3.2504  |
| MCCEL ESTIMATE                                      | 1.0469 | 0.9890 | 0.8992 | 0.9081 | 0.2748 | 0.1447  | 0.0834  | 0.0715  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 161.72 | 147.24 | 124.81 | 127.02 | 449.59 | 169.42  | 66.77   | 43.00   |
| SAMPLE STD DEVIATION                                | 0.7404 | 0.6957 | 0.5733 | 0.6434 | 0.3971 | 0.2837  | 0.1450  | 0.0665  |
| CUMULATIVE TEST TIME                                | 16.166 | 18.057 | 19.941 | 21.804 | 36.765 | 51.970  | 67.164  | 82.335  |
| CUMULATIVE FAILURES                                 | 6.3900 | 7.4900 | 7.6900 | 8.6900 | 9.7800 | 10.4800 | 11.0600 | 11.9100 |





| PHASE   | 1      | 2      | 3      | 4      | 5      | 6      | 7       | 8       |
|---|--------|--------|--------|--------|--------|--------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.3000 | 0.3000 | 0.3000 | 0.3000 | 0.7000 | 0.7000 | 0.7000  | 0.7000  |
| PLANNED TEST TIME                                   | 0.5417 | 0.5417 | 0.5417 | 0.5417 | 0.2322 | 0.2322 | 0.2322  | 0.2322  |
| ACCEL ESTIMATE                                      | 0.4091 | 0.2629 | 0.4506 | 0.4797 | 0.7849 | 0.8801 | 0.8770  | 0.9479  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 36.3E  | 20.57  | 50.21  | 59.89  | 12.08  | 29.72  | 29.29   | 39.33   |
| SAMPLE STD DEVIATION                                | 0.2150 | 0.2911 | 0.2674 | 0.2759 | 0.4691 | 0.6365 | 0.9269  | 0.9564  |
| CUMULATIVE TEST TIME                                | 4.927  | 9.532  | 14.858 | 19.747 | 21.909 | 24.061 | 26.213  | 28.341  |
| CUMULATIVE FAILURES                                 | 1.5900 | 3.0400 | 4.7300 | 6.9600 | 7.9400 | 9.0600 | 10.9100 | 12.4700 |

| PHASE   | 9       | 10      | 11      | 12      | 13      | 14      | 15      | 16      |
|---|---------|---------|---------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.4000  | 0.4000  | 0.4000  | 0.4000  | 0.0500  | 0.0500  | 0.0500  | 0.0500  |
| PLANNED TEST TIME                                   | 0.4063  | 0.4063  | 0.4063  | 0.4063  | 3.2504  | 3.2504  | 3.2504  | 3.2504  |
| ACCEL ESTIMATE                                      | 0.6137  | 0.4838  | 0.4571  | 0.5100  | 0.1312  | 0.0745  | 0.0607  | 0.0555  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 53.42   | 20.54   | 24.28   | 27.50   | 162.43  | 48.56   | 21.40   | 19.03   |
| SAMPLE STD DEVIATION                                | 0.4341  | 0.3364  | 0.3328  | 0.3241  | 0.1779  | 0.1076  | 0.0698  | 0.0457  |
| CUMULATIVE TEST TIME                                | 32.125  | 35.550  | 39.705  | 43.459  | 72.610  | 103.736 | 133.795 | 163.566 |
| CUMULATIVE FAILURES                                 | 13.6700 | 15.0600 | 16.4200 | 17.6700 | 19.1700 | 20.8400 | 22.0400 | 23.6200 |



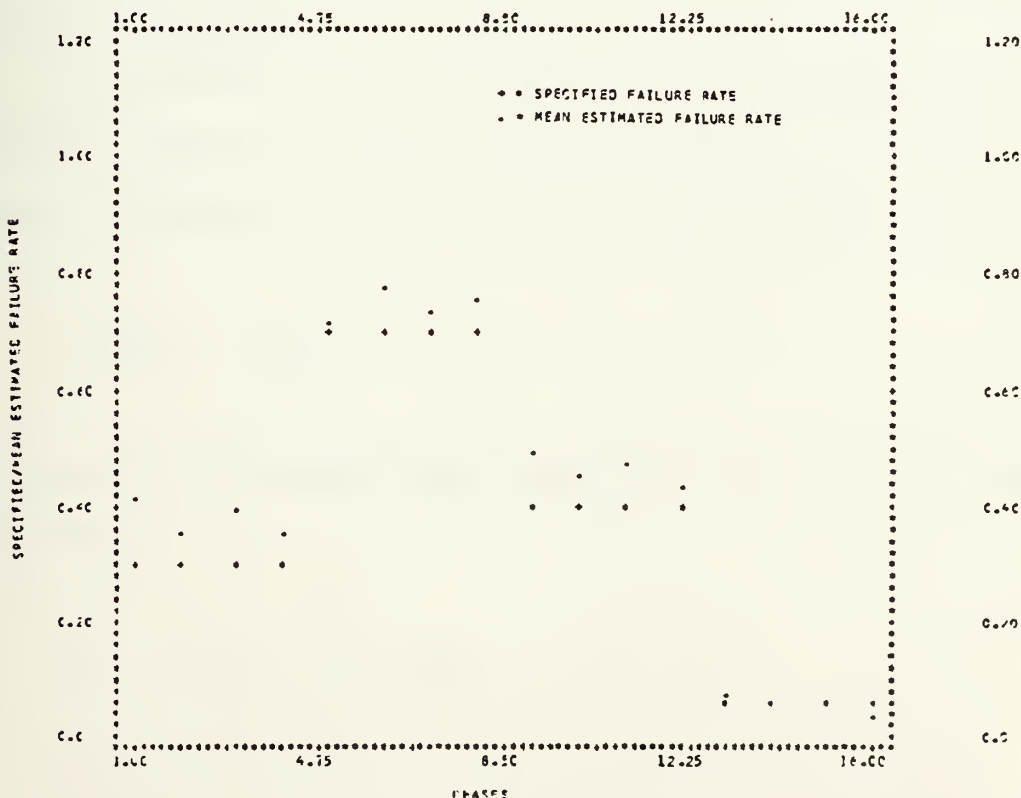


CASE 18

20 ITEMS

| PHASE   | 1      | 2      | 3      | 4       | 5       | 6       | 7       | 8       |
|---|--------|--------|--------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.3000 | 0.3000 | 0.3000 | 0.3000  | 0.7000  | 0.7000  | 0.7000  | 0.7000  |
| PLANNED TEST TIME                                   | 0.5417 | 0.5417 | 0.5417 | 0.5417  | 0.2322  | 0.2322  | 0.2322  | 0.2322  |
| MODEL ESTIMATE                                      | 0.4185 | 0.3518 | 0.4095 | 0.3681  | 0.7206  | 0.7865  | 0.7496  | 0.7502  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 39.49  | 17.25  | 36.50  | 22.70   | 2.94    | 12.26   | 7.06    | 7.17    |
| SAMPLE STD DEVIATION                                | 0.2905 | 0.1970 | 0.2566 | 0.1911  | 0.2467  | 0.4426  | 0.4265  | 0.3905  |
| CUMULATIVE TEST TIME                                | 5.596  | 19.566 | 25.890 | 29.908  | 44.206  | 46.472  | 52.744  | 57.075  |
| CUMULATIVE FAILURES                                 | 3.0300 | 5.9000 | 9.1600 | 12.0600 | 14.8100 | 17.9900 | 21.0300 | 23.9500 |

| PHASE   | 9       | 10      | 11      | 12      | 13      | 14      | 15      | 16      |
|---|---------|---------|---------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.4000  | 0.4000  | 0.4000  | 0.4000  | 0.0500  | 0.0500  | 0.0500  | 0.0500  |
| PLANNED TEST TIME                                   | 0.4063  | 0.4063  | 0.4063  | 0.4063  | 3.2504  | 3.2504  | 3.2504  | 3.2504  |
| MODEL ESTIMATE                                      | 0.5097  | 0.4649  | 0.4842  | 0.4427  | 0.0837  | 0.0521  | 0.0524  | 0.0482  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 27.42   | 16.24   | 21.05   | 10.66   | 67.20   | 4.15    | 4.85    | 3.66    |
| SAMPLE STD DEVIATION                                | 0.3713  | 0.2430  | 0.2403  | 0.2282  | 0.0963  | 0.0321  | 0.0289  | 0.0219  |
| CUMULATIVE TEST TIME                                | 64.569  | 72.091  | 79.547  | 87.097  | 147.563 | 202.226 | 267.726 | 327.823 |
| CUMULATIVE FAILURES                                 | 26.9100 | 29.8600 | 33.1100 | 36.0300 | 38.5000 | 41.5400 | 44.6200 | 47.5000 |





APPENDIX D

Results of Test MOD2

1. Test MOD2

Test MOD2 used the AMSAA model to estimate the failure rate of the items tested except as described below. A more detailed discussion of the modification can be found in Section V-D.

Use of the AMSAA model was modified as follows:

a. The point estimate of the failure rate,

$$r_p = \frac{\text{number of failures during a phase}}{\text{total test time during a phase}},$$

was used whenever cumulative test time over all items was less than 10 hours.

b. The slope of the reliability growth pattern was estimated using the current point estimate,  $r_p$ , and the previous estimate,  $\hat{r}_{i-1}$ , of the failure rate as follows:

$$\text{SLOPE} = r_p - \hat{r}_{i-1}.$$

Increasing slope was then determined from the following relationship:

$$r_p - \hat{r}_{i-1} \geq .2\hat{r}_{i-1}.$$





If the slope was increasing, the point estimate,  $r_p$ , was used as the current estimate of the failure rate. Then, the AMSAA model was reinitialized, that is, time and failures prior to an increasing slope were not considered in future estimates made by the model.

## 2. The Results

Results for Cases 4, 6, 15, and 18 are presented here as representative of the effect the modifications had on the performance of the model. A detailed description of the format of the results can be found in Appendix A.

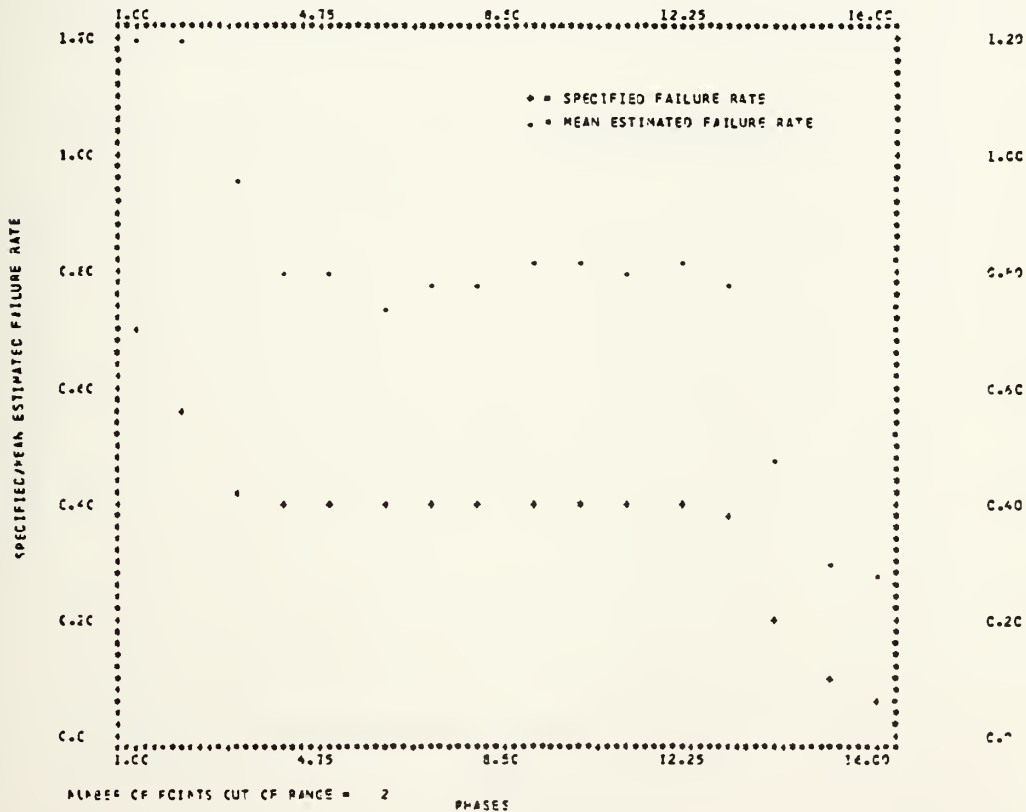


CASE 4

5 STEPS

| PHASE   | 1      | 2      | 3      | 4      | 5      | 6      | 7      | 8      |
|---|--------|--------|--------|--------|--------|--------|--------|--------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.5500 | 0.4250 | 0.4050 | 0.4000 | 0.4000 | 0.4000 | 0.4000 |
| PLANNED TEST TIME                                   | 0.2322 | 0.2555 | 0.3824 | 0.4013 | 0.4063 | 0.4063 | 0.4063 | 0.4063 |
| MODEL ESTIMATE                                      | 1.3264 | 1.3166 | 0.9675 | 0.8075 | 0.6067 | 0.7462 | 0.7767 | 0.7841 |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 89.49  | 135.74 | 127.64 | 59.37  | 101.68 | 86.26  | 94.66  | 96.03  |
| SAMPLE STD DEVIATION                                | 0.6978 | 0.7415 | 0.6545 | 0.4593 | 0.4651 | 0.4834 | 0.4941 | 0.5520 |
| CUMULATIVE TEST TIME                                | 1.074  | 2.418  | 4.202  | 6.049  | 7.942  | 9.842  | 11.697 | 13.580 |
| CUMULATIVE FAILURES                                 | 0.6400 | 1.4500 | 2.0500 | 2.8900 | 3.9500 | 4.1500 | 4.9000 | 9.7700 |

| PHASE   | 9      | 10     | 11     | 12     | 13     | 14      | 15      | 16      |
|---|--------|--------|--------|--------|--------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.4000 | 0.4000 | 0.4000 | 0.4000 | 0.3750 | 0.2000  | 0.1000  | 0.0500  |
| PLANNED TEST TIME                                   | 0.4063 | 0.4063 | 0.4063 | 0.4063 | 0.4334 | 0.8126  | 1.6252  | 3.2504  |
| MODEL ESTIMATE                                      | 0.8182 | 0.8239 | 0.7528 | 0.8124 | 0.7898 | 0.4846  | 0.2506  | 0.2921  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 104.55 | 105.98 | 98.21  | 103.11 | 110.62 | 142.28  | 150.27  | 464.13  |
| SAMPLE STD DEVIATION                                | 0.4952 | 0.4621 | 0.4572 | 0.7451 | 0.7571 | 0.4203  | 0.3418  | 1.0460  |
| CUMULATIVE TEST TIME                                | 19.442 | 17.319 | 19.186 | 21.049 | 23.079 | 26.860  | 34.326  | 49.304  |
| CUMULATIVE FAILURES                                 | 6.4400 | 7.1100 | 7.7800 | 8.3600 | 9.1700 | 10.0000 | 10.4500 | 11.5800 |



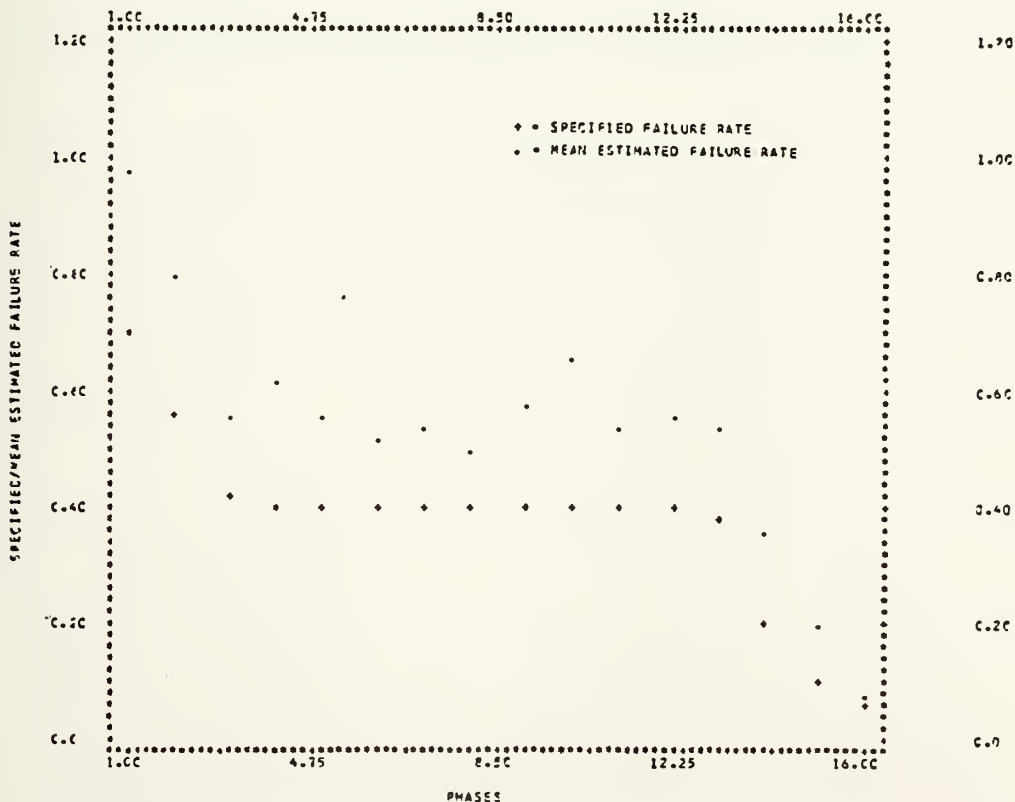


CASE 4

10 ITEMS

| PHASE   | 1      | 2      | 3      | 4      | 5      | 6      | 7       | 8       |
|---|--------|--------|--------|--------|--------|--------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.5500 | 0.4250 | 0.4050 | 0.4000 | 0.4000 | 0.4000  | 0.4000  |
| PLANNED TEST TIME                                   | 0.2322 | 0.2555 | 0.3024 | 0.4013 | 0.4063 | 0.4063 | 0.4063  | 0.4063  |
| POCEL ESTIMATE                                      | 0.9739 | 0.7546 | 0.5631 | 0.6275 | 0.5517 | 0.5162 | 0.5330  | 0.4920  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 39.13  | 44.48  | 32.50  | 54.94  | 37.93  | 25.06  | 33.24   | 23.25   |
| SAMPLE STD DEVIATION                                | 0.6085 | 0.5476 | 0.3305 | 0.6033 | 0.2743 | 0.2771 | 0.3637  | 0.3044  |
| CUMULATIVE TEST TIME                                | 2.136  | 4.687  | 8.462  | 12.133 | 15.882 | 19.623 | 23.410  | 27.195  |
| CUMULATIVE FAILURES                                 | 1.5400 | 2.8200 | 4.1100 | 5.7400 | 7.1600 | 8.4100 | 10.1000 | 11.4100 |

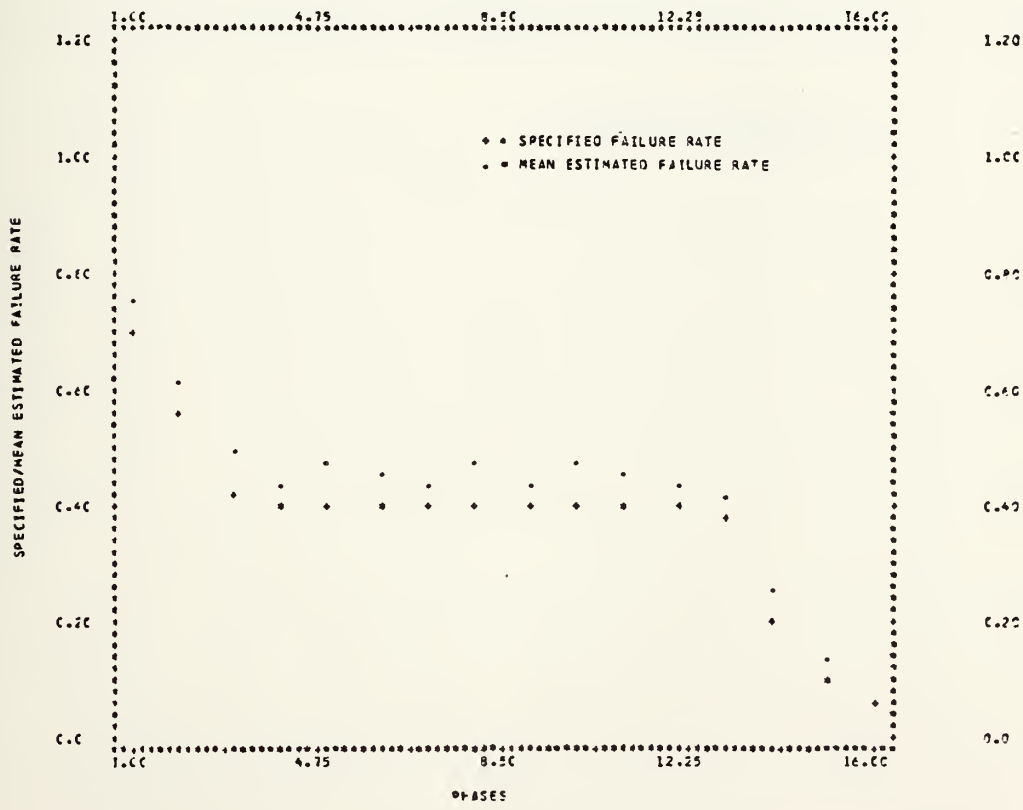
| PHASE   | 9       | 10      | 11      | 12      | 13      | 14      | 15      | 16      |
|---|---------|---------|---------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.4000  | 0.4000  | 0.4000  | 0.4000  | 0.3750  | 0.2000  | 0.1000  | 0.0500  |
| PLANNED TEST TIME                                   | 0.4063  | 0.4063  | 0.4063  | 0.4063  | 0.4334  | 0.8126  | 1.6252  | 3.2504  |
| POCEL ESTIMATE                                      | 0.5740  | 0.6525  | 0.5374  | 0.5670  | 0.5484  | 0.3801  | 0.1960  | 0.0884  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 43.51   | 63.11   | 34.35   | 41.75   | 46.23   | 80.04   | 95.98   | 76.71   |
| SAMPLE STD DEVIATION                                | 0.3474  | 1.6596  | 0.3229  | 0.3362  | 0.3532  | 0.2651  | 0.1523  | 0.0582  |
| CUMULATIVE TEST TIME                                | 30.542  | 34.723  | 38.459  | 42.187  | 46.178  | 53.627  | 66.565  | 98.201  |
| CUMULATIVE FAILURES                                 | 12.9700 | 14.4500 | 16.0100 | 17.2200 | 18.6200 | 20.5800 | 22.1900 | 23.9300 |





| PHASE   | 1      | 2      | 3      | 4       | 5       | 6       | 7       | 8       |
|---|--------|--------|--------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.5500 | 0.4250 | 0.4050  | 0.4000  | 0.4000  | 0.4000  | 0.4000  |
| PLANNED TEST TIME                                   | 0.2322 | 0.2555 | 0.3824 | 0.4013  | 0.4063  | 0.4063  | 0.4063  | 0.4063  |
| MODEL ESTIMATE                                      | 0.7576 | 0.6134 | 0.5010 | 0.4458  | 0.4752  | 0.4907  | 0.4448  | 0.4703  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 8.23   | 11.53  | 17.88  | 10.07   | 15.81   | 12.67   | 11.15   | 17.96   |
| SAMPLE STD DEVIATION                                | 0.4180 | 0.3452 | 0.2728 | 0.2616  | 0.3128  | 0.2457  | 0.2144  | 0.2141  |
| CUMULATIVE TEST TIME                                | 4.313  | 9.758  | 16.874 | 24.303  | 31.798  | 35.327  | 46.755  | 54.188  |
| CUMULATIVE FAILURES                                 | 2.9500 | 5.8600 | 8.8700 | 11.7100 | 14.7100 | 17.6100 | 20.8300 | 23.8500 |

| PHASE   | 9       | 10      | 11      | 12      | 13      | 14      | 15      | 16      |
|---|---------|---------|---------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.4000  | 0.4000  | 0.4000  | 0.4000  | 0.3750  | 0.2000  | 0.1000  | 0.0500  |
| PLANNED TEST TIME                                   | 0.4063  | 0.4063  | 0.4063  | 0.4063  | 0.4334  | 0.8126  | 1.6252  | 3.2504  |
| MODEL ESTIMATE                                      | 0.4444  | 0.4709  | 0.4536  | 0.4404  | 0.4203  | 0.2571  | 0.1403  | 0.0696  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 11.11   | 17.72   | 13.40   | 10.10   | 12.07   | 28.23   | 40.30   | 35.72   |
| SAMPLE STD DEVIATION                                | 0.2009  | 0.2357  | 0.2362  | 0.2134  | 0.2216  | 0.1556  | 0.0543  | 0.0302  |
| CUMULATIVE TEST TIME                                | 61.676  | 69.122  | 76.672  | 84.172  | 92.154  | 107.154 | 127.320 | 197.437 |
| CUMULATIVE FAILURES                                 | 27.0400 | 30.2200 | 32.8500 | 36.1700 | 39.0600 | 42.0600 | 44.8000 | 47.8000 |

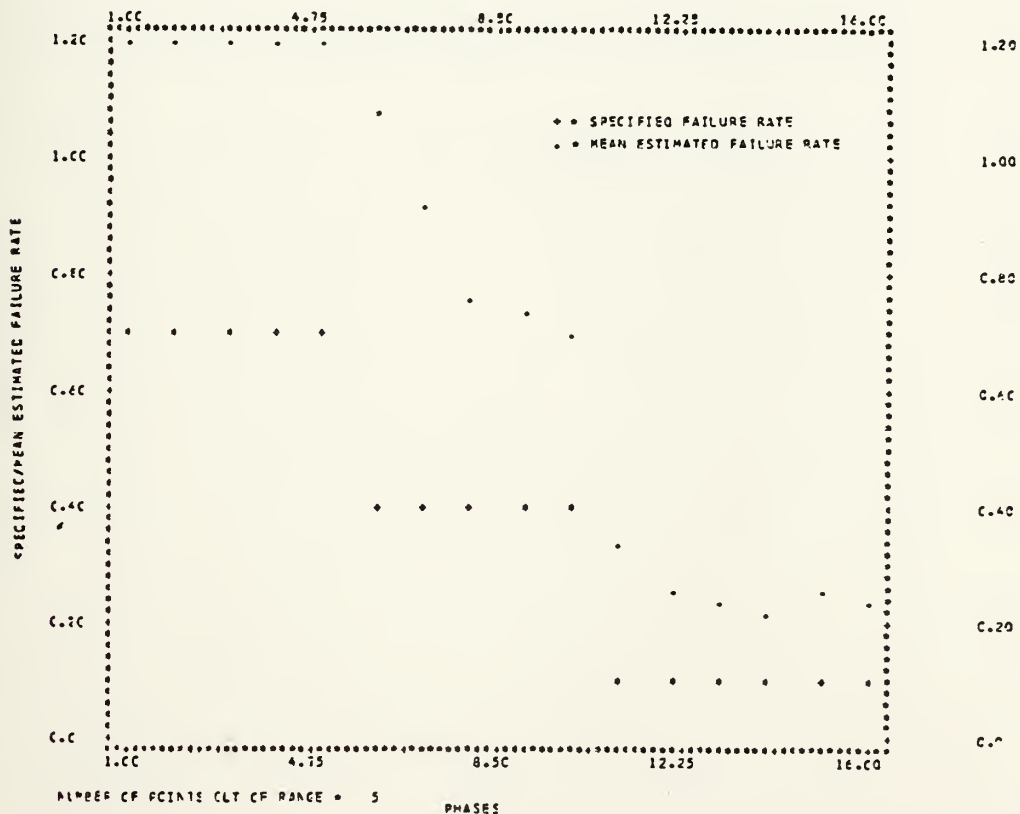






| PHASE   | 1      | 2      | 3      | 4      | 5      | 6      | 7      | 8      |
|---|--------|--------|--------|--------|--------|--------|--------|--------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.7000 | 0.7000 | 0.7000 | 0.7000 | 0.4000 | 0.4000 | 0.4000 |
| PLANNED TEST TIME                                   | 0.2322 | 0.2322 | 0.2322 | 0.2322 | 0.2322 | 0.4063 | 0.4063 | 0.4063 |
| POCEL ESTIMATE                                      | 1.3652 | 1.4585 | 1.3739 | 1.4043 | 1.3421 | 1.0711 | 0.9757 | 0.7634 |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 95.03  | 108.36 | 96.28  | 100.61 | 91.72  | 167.77 | 128.53 | 90.10  |
| SAMPLE STD DEVIATION                                | 0.6434 | 0.8648 | 0.7931 | 0.7801 | 0.6943 | 0.7167 | 0.6386 | 0.4695 |
| CUMULATIVE TEST TIME                                | 1.061  | 2.128  | 3.209  | 4.305  | 5.374  | 7.210  | 9.075  | 10.968 |
| CUMULATIVE FAILURES                                 | 0.7400 | 1.4100 | 2.1100 | 2.8400 | 3.4700 | 4.4200 | 4.9600 | 5.6500 |

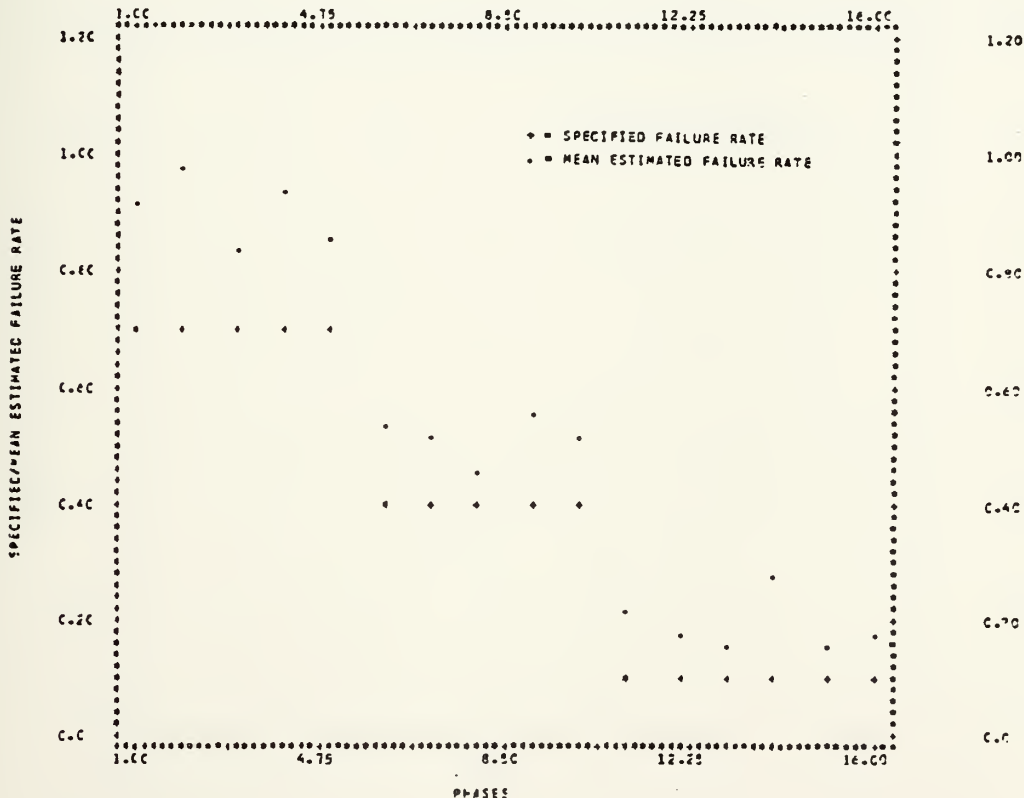
| PHASE   | 9      | 10     | 11     | 12     | 13     | 14      | 15      | 16      |
|---|--------|--------|--------|--------|--------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.4000 | 0.4000 | 0.1000 | 0.1000 | 0.1000 | 0.1000  | 0.1000  | 0.1000  |
| PLANNED TEST TIME                                   | 0.4063 | 0.4063 | 1.6252 | 1.6252 | 1.6252 | 1.6252  | 1.6252  | 1.6252  |
| POCEL ESTIMATE                                      | 0.7254 | 0.7056 | 0.3340 | 0.2607 | 0.2375 | 0.2262  | 0.2507  | 0.2369  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 83.88  | 77.35  | 233.45 | 160.72 | 137.47 | 126.17  | 150.67  | 136.90  |
| SAMPLE STD DEVIATION                                | 0.5135 | 0.5252 | 0.4373 | 0.2927 | 0.2092 | 0.1717  | 0.3109  | 0.1637  |
| CUMULATIVE TEST TIME                                | 12.856 | 14.742 | 22.241 | 29.722 | 37.201 | 44.676  | 52.044  | 59.922  |
| CUMULATIVE FAILURES                                 | 6.6000 | 7.0200 | 7.8200 | 8.8300 | 9.6300 | 10.1500 | 10.8500 | 11.5100 |





| PHASE   | 1      | 2      | 3      | 4      | 5      | 6      | 7      | 8       |
|---|--------|--------|--------|--------|--------|--------|--------|---------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.7000 | 0.7000 | 0.7000 | 0.7000 | 0.4000 | 0.4000 | 0.4000  |
| PLANNED TEST TIME                                   | 0.2322 | 0.2322 | 0.2322 | 0.2322 | 0.2322 | 0.4063 | 0.4063 | 0.4063  |
| MODEL ESTIMATE                                      | 0.9152 | 0.9703 | 0.8404 | 0.9337 | 0.8568 | 0.5468 | 0.5277 | 0.4544  |
| ESTIMATE EFFCR AS PERCENTAGE OF ACTUAL FAILURE RATE | 11.22  | 38.62  | 20.05  | 33.38  | 22.40  | 16.71  | 31.93  | 12.59   |
| SAMPLE STD DEVIATION                                | 0.5079 | 0.5932 | 0.4066 | 0.4841 | 0.4544 | 0.4441 | 0.4024 | 0.3793  |
| CUMULATIVE TEST TIME                                | 2.158  | 4.277  | 6.441  | 8.553  | 10.725 | 14.455 | 18.287 | 27.097  |
| CUMULATIVE FAILURES                                 | 1.3500 | 2.9200 | 4.3100 | 5.9200 | 7.0600 | 8.6600 | 9.9800 | 11.1700 |

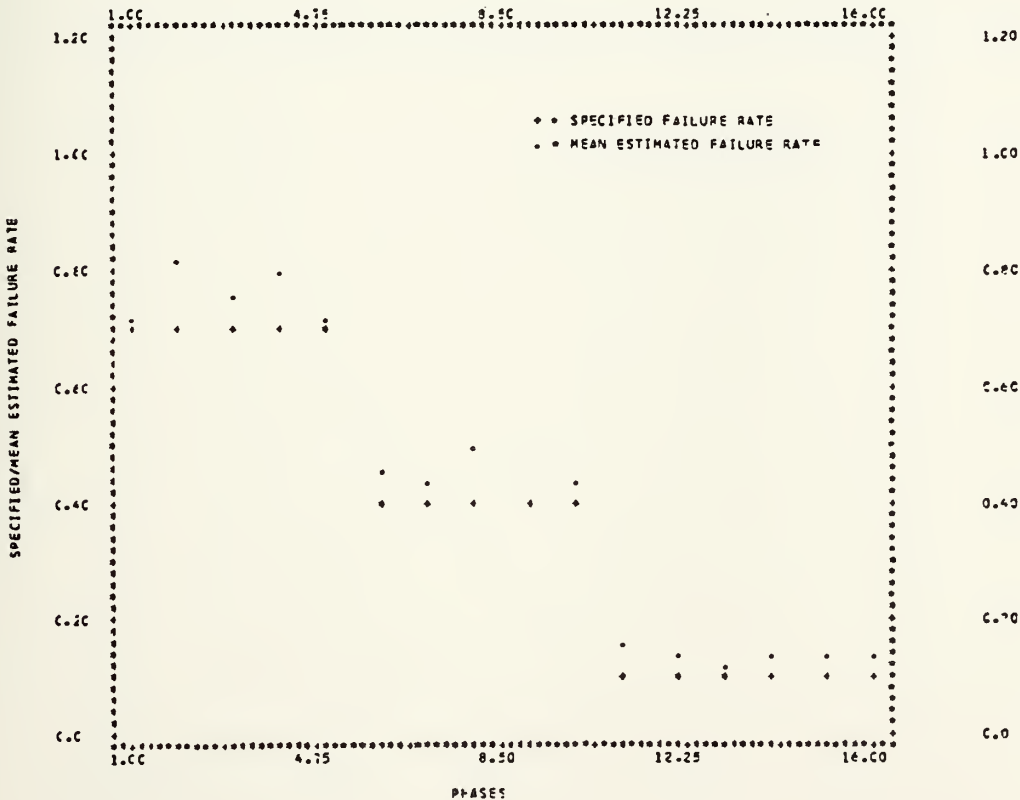
| PHASE   | 9       | 10      | 11      | 12      | 13      | 14      | 15      | 16      |
|---|---------|---------|---------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.4000  | 0.4000  | 0.1000  | 0.1000  | 0.1000  | 0.1000  | 0.1000  | 0.1000  |
| PLANNED TEST TIME                                   | 0.4063  | 0.4063  | 1.6252  | 1.6252  | 1.6252  | 1.6252  | 1.6252  | 1.6252  |
| MODEL ESTIMATE                                      | 0.5124  | 0.5131  | 0.2114  | 0.1731  | 0.1586  | 0.2852  | 0.1665  | 0.1746  |
| ESTIMATE EFFCR AS PERCENTAGE OF ACTUAL FAILURE RATE | 38.10   | 28.27   | 111.36  | 73.07   | 58.60   | 189.23  | 66.48   | 74.65   |
| SAMPLE STD DEVIATION                                | 0.3345  | 0.2949  | 0.2015  | 0.1854  | 0.1254  | 1.0424  | 0.1050  | 0.1005  |
| CUMULATIVE TEST TIME                                | 25.831  | 29.565  | 44.552  | 59.418  | 74.438  | 85.320  | 104.331 | 119.306 |
| CUMULATIVE FAILURES                                 | 12.7500 | 13.9400 | 15.3500 | 17.4500 | 19.0200 | 20.4700 | 22.1600 | 22.7700 |





| PHASE   | 1      | 2      | 3      | 4       | 5       | 6       | 7       | 8       |
|---|--------|--------|--------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.7000 | 0.7000 | 0.7000  | 0.7000  | 0.4000  | 0.4000  | 0.4000  |
| PLANNED TEST TIME                                   | 0.2322 | 0.2322 | 0.2322 | 0.2322  | 0.2322  | 0.4063  | 0.4063  | 0.4063  |
| MCCEL ESTIMATE                                      | 0.7291 | 0.8171 | 0.7619 | 0.7920  | 0.7287  | 0.4545  | 0.4458  | 0.4441  |
| ESTIMATE EFFCR AS PERCENTAGE OF ACTUAL FAILURE RATE | 3.58   | 16.72  | 8.84   | 13.14   | 4.10    | 13.44   | 11.44   | 13.23   |
| SAMPLE STD DEVIATION                                | 0.4087 | 0.4078 | 0.4044 | 0.3825  | 0.4318  | 0.2423  | 0.1882  | 0.2411  |
| CUMULATIVE TEST TIME                                | 4.254  | 8.561  | 12.842 | 17.130  | 21.415  | 28.505  | 36.410  | 43.831  |
| CUMULATIVE FAILURES                                 | 2.7700 | 6.0000 | 9.2000 | 12.3000 | 15.2100 | 18.0700 | 21.0200 | 24.3000 |

| PHASE   | 9       | 10      | 11      | 12      | 13      | 14      | 15      | 16      |
|---|---------|---------|---------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.4000  | 0.4000  | 0.1000  | 0.1000  | 0.1000  | 0.1000  | 0.1000  | 0.1000  |
| PLANNED TEST TIME                                   | 0.4063  | 0.4063  | 1.6252  | 1.6252  | 1.6252  | 1.6252  | 1.6252  | 1.6252  |
| MCCEL ESTIMATE                                      | 0.4030  | 0.4359  | 0.1645  | 0.1306  | 0.1320  | 0.1385  | 0.1382  | 0.1405  |
| ESTIMATE EFFCR AS PERCENTAGE OF ACTUAL FAILURE RATE | 0.74    | 5.58    | 64.48   | 30.57   | 21.58   | 38.52   | 38.19   | 30.87   |
| SAMPLE STD DEVIATION                                | 0.2055  | 0.2249  | 0.1760  | 0.0585  | 0.0487  | 0.1138  | 0.1131  | 0.0685  |
| CUMULATIVE TEST TIME                                | 51.373  | 58.856  | 88.818  | 118.487 | 148.455 | 178.515 | 208.545 | 238.637 |
| CUMULATIVE FAILURES                                 | 27.0300 | 30.0600 | 33.1700 | 36.4600 | 35.4300 | 41.9700 | 45.2600 | 48.2200 |

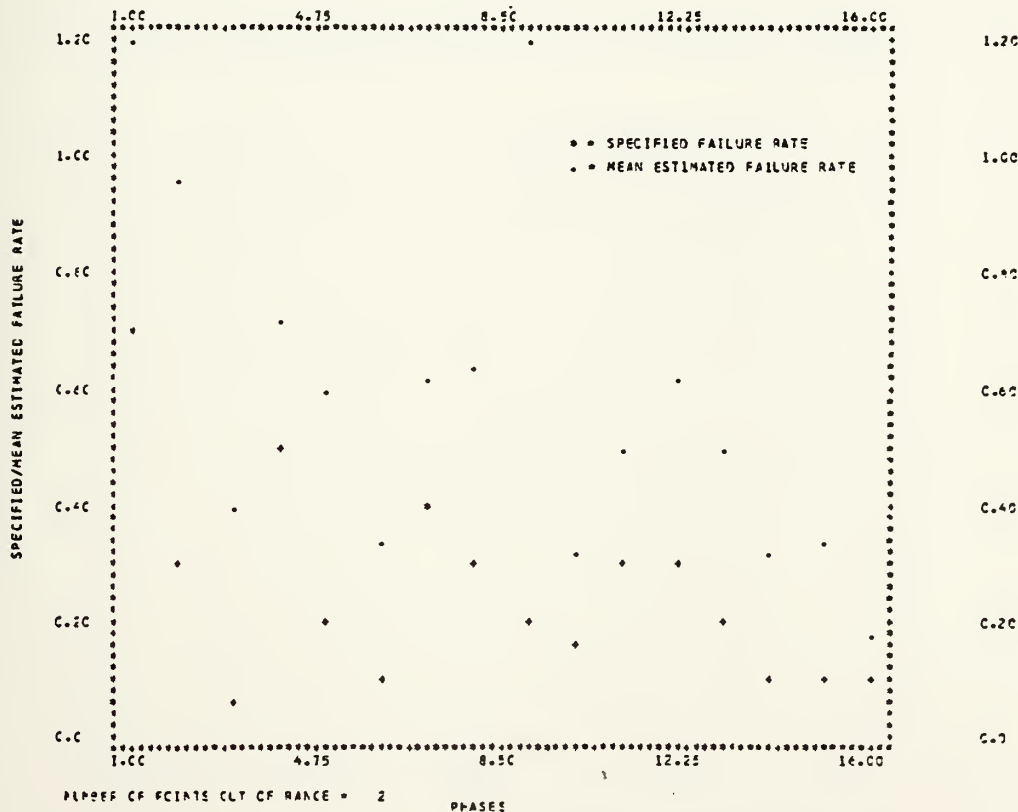




| PHASE   | 1      | 2      | 3      | 4      | 5      | 6      | 7      | 8      |
|---|--------|--------|--------|--------|--------|--------|--------|--------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.3000 | 0.0500 | 0.5000 | 0.2000 | 0.1000 | 0.4000 | 0.7000 |
| PLANNED TEST TIME                                   | 0.2322 | 0.9417 | 3.2504 | 0.3250 | 0.8126 | 1.6252 | 0.4063 | 0.9417 |
| MCCEL ESTIMATE                                      | 1.5230 | 0.9698 | 0.4058 | 0.7188 | 0.5982 | 0.3474 | 0.6154 | 0.6282 |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 117.57 | 223.26 | 711.51 | 43.77  | 199.10 | 247.40 | 53.64  | 112.73 |
| SAMPLE STD DEVIATION                                | 1.0053 | 0.8302 | 0.8308 | 0.6278 | 0.5043 | 0.3731 | 0.5061 | 0.4725 |
| CUMULATIVE TEST TIME                                | 1.074  | 3.573  | 18.481 | 19.990 | 23.722 | 31.225 | 33.112 | 39.875 |
| CUMULATIVE FAILURES                                 | 0.7500 | 1.4000 | 2.1600 | 2.9300 | 3.5100 | 4.3200 | 4.9600 | 5.7600 |

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| PHASE   | 9       | 10     | 11     | 12     | 13     | 14      | 15      | 16      |
|---|---------|--------|--------|--------|--------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.2000  | 0.1500 | 0.3000 | 0.3000 | 0.2000 | 0.1000  | 0.1000  | 0.1000  |
| PLANNED TEST TIME                                   | 0.8126  | 1.0635 | 0.5417 | 0.5417 | 0.8126 | 1.6252  | 1.6252  | 1.6252  |
| MCCEL ESTIMATE                                      | 2.5016  | 0.3201 | 0.4580 | 0.6164 | 0.4992 | 0.3215  | 0.2405  | 0.1782  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 1150.80 | 113.39 | 66.01  | 105.46 | 149.59 | 221.54  | 240.53  | 76.34   |
| SAMPLE STD DEVIATION                                | 19.8357 | 0.2558 | 0.3740 | 0.3707 | 0.3226 | 0.5710  | 1.3138  | 0.1617  |
| CUMULATIVE TEST TIME                                | 39.351  | 44.268 | 46.786 | 49.254 | 53.005 | 60.484  | 68.097  | 75.729  |
| CUMULATIVE FAILURES                                 | 6.3500  | 7.3600 | 8.3100 | 8.7000 | 9.5700 | 10.3600 | 11.0700 | 11.7200 |

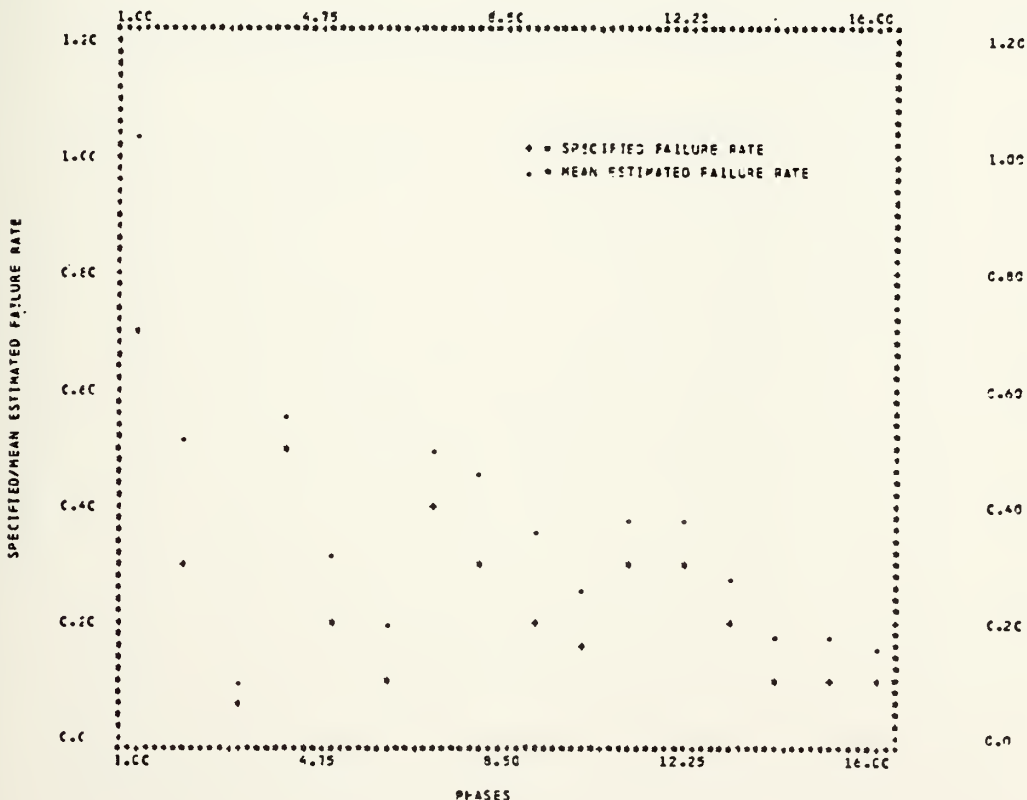






| PHASE   | 1      | 2      | 3      | 4      | 5      | 6      | 7       | 8       |
|---|--------|--------|--------|--------|--------|--------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.3000 | 0.0500 | 0.5000 | 0.2000 | 0.1000 | 0.4000  | 0.3000  |
| PLANNED TEST TIME                                   | 0.2322 | 0.5417 | 3.2204 | 0.3250 | 0.8126 | 1.6252 | 0.4063  | 0.5417  |
| MCCEL ESTIMATE                                      | 1.0252 | 0.5182 | 0.0987 | 0.5584 | 0.3268 | 0.1932 | 0.4522  | 0.4603  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 48.44  | 72.74  | 97.43  | 11.69  | 63.41  | 93.24  | 23.04   | 23.43   |
| SAMPLE STC DEVIATION                                | 0.5388 | 0.3643 | 0.1555 | 0.4639 | 0.2906 | 0.1759 | 0.3222  | 0.2654  |
| CUMULATIVE TEST TIME                                | 2.104  | 7.053  | 37.101 | 40.105 | 47.606 | 62.576 | 66.304  | 71.262  |
| CUMULATIVE FAILURES                                 | 1.7700 | 3.2400 | 4.8900 | 6.3000 | 7.8200 | 9.2700 | 10.9500 | 12.4700 |

| PHASE   | 9       | 10      | 11      | 12      | 13      | 14      | 15      | 16      |
|---|---------|---------|---------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.2000  | 0.1500  | 0.3000  | 0.3000  | 0.2000  | 0.1000  | 0.1000  | 0.1000  |
| PLANNED TEST TIME                                   | 0.8126  | 1.0252  | 0.5417  | 0.5417  | 0.8126  | 1.6252  | 1.6252  | 1.6252  |
| MCCEL ESTIMATE                                      | 0.3500  | 0.2513  | 0.3859  | 0.3844  | 0.2765  | 0.1708  | 0.1700  | 0.1675  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 75.00   | 67.51   | 28.64   | 28.13   | 38.43   | 70.84   | 70.01   | 62.54   |
| SAMPLE STC DEVIATION                                | 0.3257  | 0.2239  | 0.2644  | 0.2298  | 0.2123  | 0.1212  | 0.1789  | 0.1242  |
| CUMULATIVE TEST TIME                                | 78.788  | 88.725  | 93.707  | 98.702  | 106.248 | 121.305 | 136.257 | 151.192 |
| CUMULATIVE FAILURES                                 | 13.6500 | 15.5700 | 16.8200 | 18.6800 | 19.9200 | 21.4100 | 22.2900 | 24.3600 |



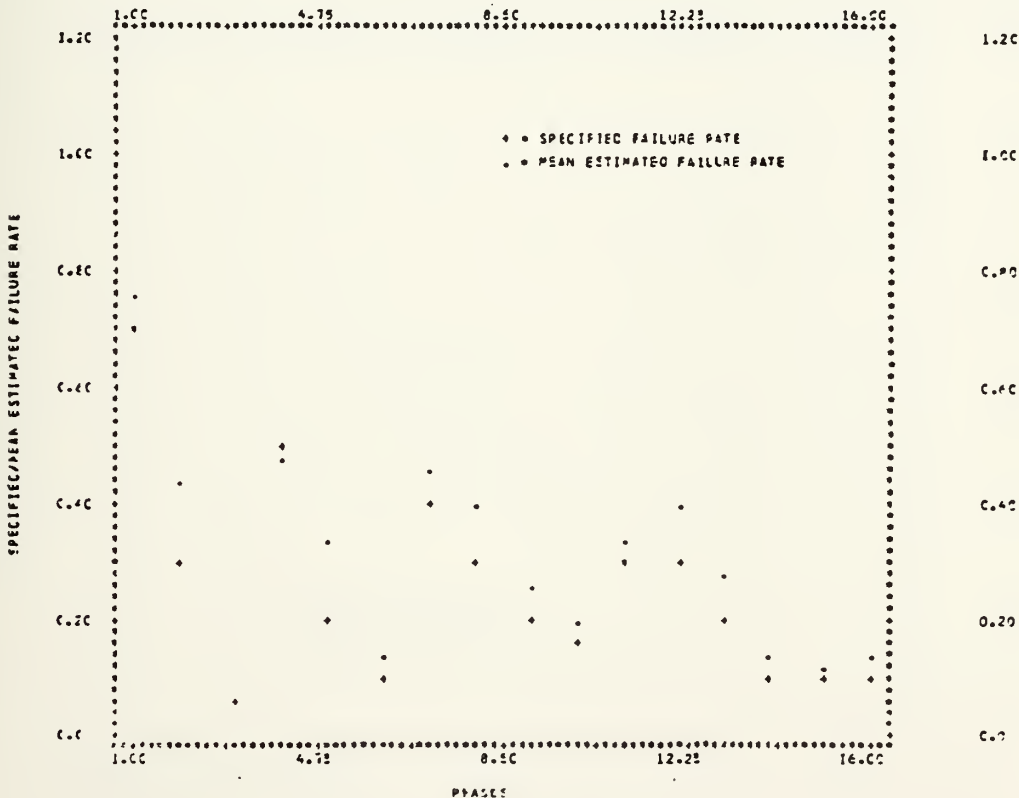


CASE 15

20 STEPS

| PHASE   | 1      | 2      | 3      | 4       | 5       | 6       | 7       | 8       |
|---|--------|--------|--------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.3000 | 0.0500 | 0.5000  | 0.2000  | 0.3000  | 0.4000  | 0.1000  |
| PLANNED TEST TIME                                   | 0.2222 | 0.3417 | 3.2504 | 0.3250  | 0.8126  | 1.6252  | 0.4063  | 0.5417  |
| MCCEL ESTIMATE                                      | 0.7622 | 0.4363 | 0.0615 | 0.4776  | 0.3365  | 0.3264  | 0.4543  | 0.3522  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 8.85   | 46.43  | 22.92  | 4.48    | 68.45   | 36.44   | 13.36   | 30.72   |
| SAMPLE STD DEVIATION                                | 0.4205 | 0.3188 | 0.0390 | 0.3072  | 0.3103  | 0.0668  | 0.2614  | 0.2672  |
| CUMULATIVE TEST TIME                                | 4.272  | 14.288 | 74.066 | 80.098  | 95.034  | 124.511 | 122.346 | 142.278 |
| CUMULATIVE FAILURES                                 | 2.9500 | 5.8100 | 9.0000 | 11.7600 | 14.7300 | 18.0500 | 21.3200 | 24.4500 |

| PHASE   | 9       | 10      | 11      | 12      | 13      | 14      | 15      | 16      |
|---|---------|---------|---------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.2000  | 0.1500  | 0.3000  | 0.3000  | 0.2000  | 0.1000  | 0.1000  | 0.1000  |
| PLANNED TEST TIME                                   | 0.8126  | 1.0635  | 0.5417  | 0.5417  | 0.8126  | 1.6252  | 1.6252  | 1.6252  |
| MCCEL ESTIMATE                                      | 0.2275  | 0.1685  | 0.3350  | 0.3983  | 0.2812  | 0.1403  | 0.1222  | 0.1776  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 26.95   | 32.33   | 12.95   | 32.77   | 40.60   | 49.34   | 22.16   | 37.67   |
| SAMPLE STD DEVIATION                                | 0.1616  | 0.1060  | 0.1568  | 0.2533  | 0.1828  | 0.0844  | 0.0535  | 0.1243  |
| CUMULATIVE TEST TIME                                | 157.243 | 177.242 | 187.247 | 197.196 | 212.154 | 242.173 | 272.298 | 302.306 |
| CUMULATIVE FAILURES                                 | 27.4000 | 30.4300 | 33.4100 | 36.6600 | 39.6100 | 42.6600 | 45.4500 | 47.9700 |



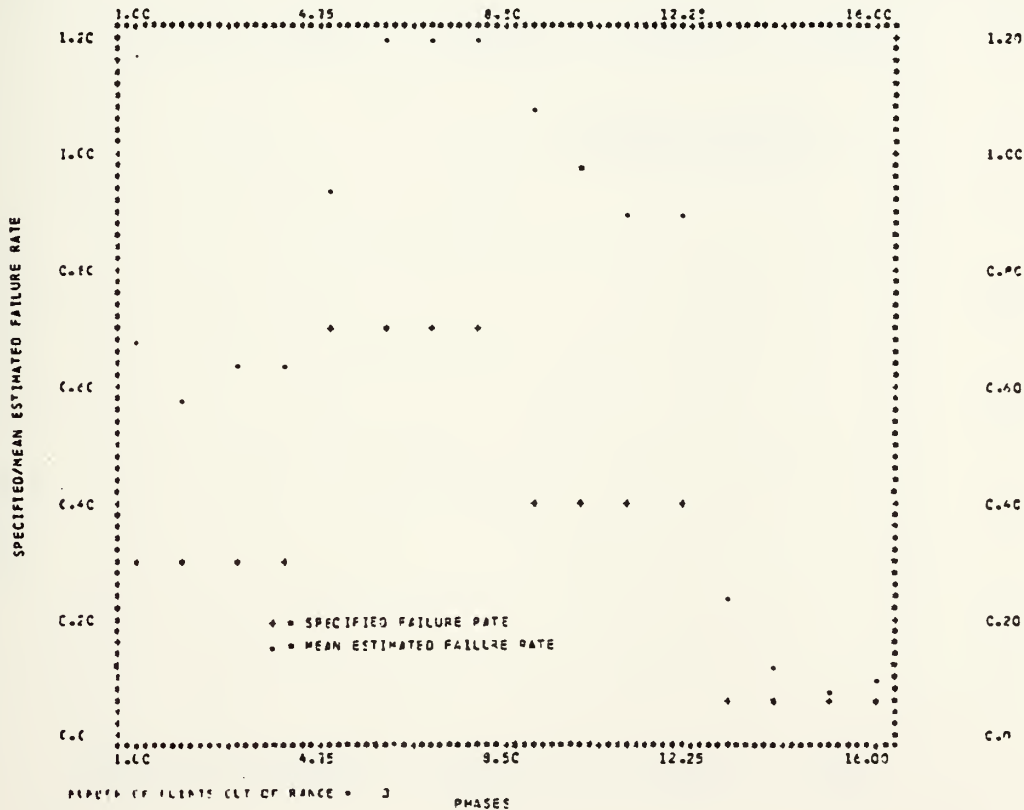


CASE 18

3 ITEMS

| PHASE   | 1      | 2      | 3      | 4      | 5      | 6      | 7      | 8      |
|---|--------|--------|--------|--------|--------|--------|--------|--------|
| ACTUAL FAILURE RATE                                 | 0.3000 | 0.3000 | 0.3000 | 0.3000 | 0.7000 | 0.7000 | 0.7000 | 0.7000 |
| PLANNED TEST TIME                                   | 0.5417 | 0.5417 | 0.5417 | 0.5417 | 0.2322 | 0.2322 | 0.2322 | 0.2322 |
| MCCEL ESTIMATE                                      | 0.6856 | 0.5759 | 0.6478 | 0.6409 | 0.5320 | 1.2516 | 1.4142 | 1.5044 |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 128.55 | 91.56  | 115.55 | 113.64 | 33.14  | 64.52  | 102.02 | 114.51 |
| SAMPLE STD DEVIATION                                | 0.3824 | 0.3068 | 0.3514 | 0.3941 | 0.6545 | 0.8306 | 0.8361 | 0.8525 |
| CUMULATIVE TEST TIME                                | 2.509  | 5.042  | 7.507  | 10.020 | 11.119 | 12.158 | 13.223 | 14.286 |
| CUMULATIVE FAILURES                                 | 0.7100 | 1.3300 | 2.1800 | 2.7800 | 3.3600 | 4.2700 | 4.9600 | 5.5700 |

| PHASE   | 9      | 10     | 11     | 12     | 13     | 14      | 15      | 16      |
|---|--------|--------|--------|--------|--------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.4000 | 0.4000 | 0.4000 | 0.4000 | 0.0500 | 0.0500  | 0.0500  | 0.0500  |
| PLANNED TEST TIME                                   | 0.4063 | 0.4063 | 0.4063 | 0.4063 | 3.2504 | 3.2504  | 3.2504  | 3.2504  |
| MCCEL ESTIMATE                                      | 1.0843 | 0.9800 | 0.8954 | 0.9058 | 0.2407 | 0.1281  | 0.0863  | 0.0511  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 171.06 | 145.01 | 123.85 | 126.46 | 361.37 | 156.22  | 72.53   | 82.17   |
| SAMPLE STD DEVIATION                                | 0.8805 | 0.6514 | 0.6215 | 0.6619 | 0.3637 | 0.2458  | 0.1288  | 0.0750  |
| CUMULATIVE TEST TIME                                | 16.166 | 18.057 | 19.541 | 21.804 | 26.765 | 31.570  | 37.164  | 42.335  |
| CUMULATIVE FAILURES                                 | 6.3500 | 7.4500 | 7.7700 | 8.6900 | 9.7800 | 10.3500 | 11.0500 | 11.7500 |



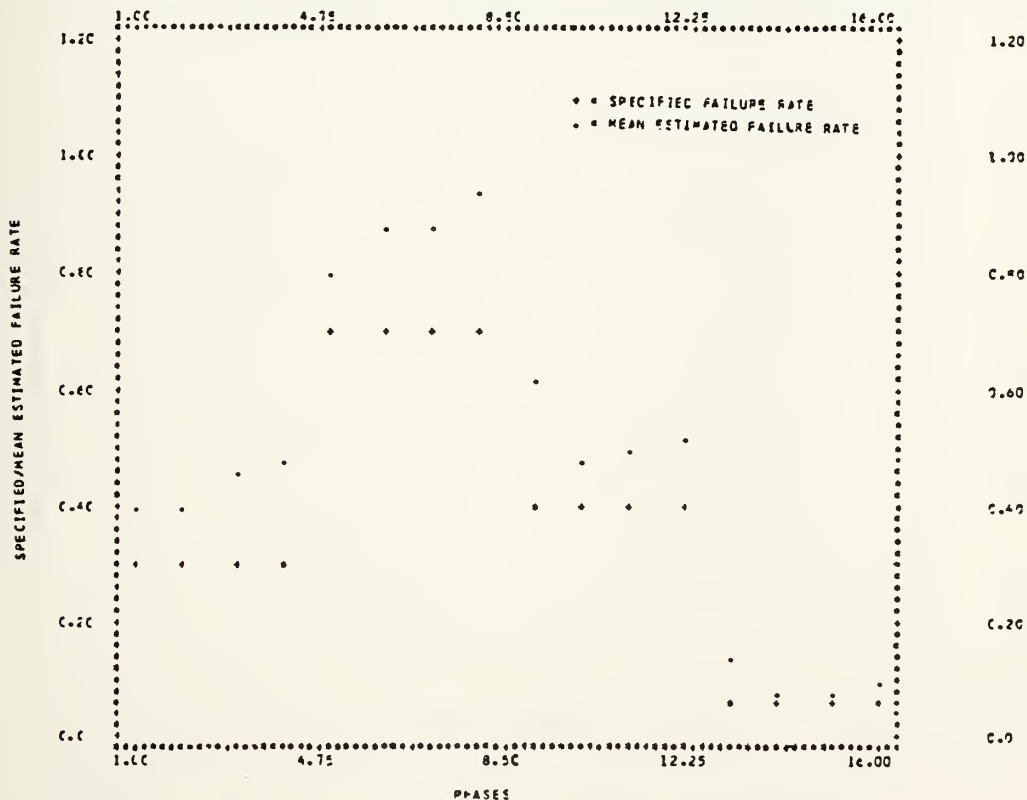


CASE 18

10 STEP

| PHASE   | 1      | 2      | 3      | 4      | 5      | 6      | 7       | 8       |
|---|--------|--------|--------|--------|--------|--------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.3000 | 0.3000 | 0.3000 | 0.3000 | 0.7000 | 0.7000 | 0.7000  | 0.7000  |
| PLANNED TEST TIME                                   | 0.5417 | 0.5417 | 0.5417 | 0.5417 | 0.2322 | 0.2322 | 0.2322  | 0.2322  |
| MODEL ESTIMATE                                      | 0.4061 | 0.3541 | 0.4504 | 0.4895 | 0.7903 | 0.8802 | 0.8770  | 0.9473  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 36.38  | 21.37  | 50.13  | 63.18  | 12.90  | 25.74  | 25.59   | 35.33   |
| SAMPLE STD DEVIATION                                | 0.2150 | 0.2343 | 0.2807 | 0.2789 | 0.4813 | 0.6384 | 0.5285  | 0.5064  |
| CUMULATIVE TEST TIME                                | 4.527  | 9.932  | 14.858 | 19.747 | 21.905 | 24.061 | 26.213  | 28.341  |
| CUMULATIVE FAILURES                                 | 1.5900 | 2.9700 | 4.7300 | 6.5600 | 7.9700 | 9.0600 | 10.8100 | 12.4700 |

| PHASE   | 9       | 10      | 11      | 12      | 13      | 14      | 15      | 16      |
|---|---------|---------|---------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.4000  | 0.4000  | 0.4000  | 0.4000  | 0.0500  | 0.0500  | 0.0500  | 0.0500  |
| PLANNED TEST TIME                                   | 0.4063  | 0.4063  | 0.4063  | 0.4063  | 3.2504  | 3.2504  | 3.2504  | 3.2504  |
| MODEL ESTIMATE                                      | 0.6132  | 0.4767  | 0.4553  | 0.5173  | 0.1325  | 0.0797  | 0.0700  | 0.0577  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 53.31   | 19.67   | 23.82   | 29.33   | 144.95  | 59.48   | 40.10   | 54.28   |
| SAMPLE STD DEVIATION                                | 0.4347  | 0.3389  | 0.3316  | 0.3239  | 0.1755  | 0.1069  | 0.0671  | 0.2064  |
| CUMULATIVE TEST TIME                                | 32.125  | 35.990  | 39.705  | 43.459  | 73.610  | 103.736 | 133.705 | 163.986 |
| CUMULATIVE FAILURES                                 | 13.6700 | 15.0600 | 16.4200 | 17.6700 | 18.1700 | 20.8400 | 22.0400 | 23.4700 |







| PHASE   | 1      | 2      | 3      | 4       | 5       | 6       | 7       | 8       |
|---|--------|--------|--------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.3000 | 0.3000 | 0.3000 | 0.3000  | 0.7000  | 0.7000  | 0.7000  | 0.7000  |
| PLANNED TEST TIME                                   | 0.5417 | 0.5417 | 0.5417 | 0.5417  | 0.2322  | 0.2322  | 0.2322  | 0.2322  |
| MCCEL ESTIMATE                                      | 0.3215 | 0.3610 | 0.4089 | 0.3709  | 0.7200  | 0.7650  | 0.7526  | 0.7459  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 7.16   | 20.34  | 36.29  | 23.62   | 2.86    | 12.72   | 7.91    | 7.13    |
| SAMPLE STD DEVIATION                                | 0.1815 | 0.3142 | 0.3177 | 0.2027  | 0.3510  | 0.4414  | 0.4237  | 0.3509  |
| CUMULATIVE TEST TIME                                | 9.556  | 19.586 | 29.890 | 39.908  | 44.206  | 48.475  | 52.744  | 57.039  |
| CUMULATIVE FAILURES                                 | 3.0300 | 5.9000 | 9.1800 | 12.0600 | 14.8100 | 17.9500 | 21.0300 | 23.9500 |

| PHASE   | 9       | 10      | 11      | 12      | 13      | 14      | 15      | 16      |
|---|---------|---------|---------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.4000  | 0.4000  | 0.4000  | 0.4000  | 0.6500  | 0.6500  | 0.6500  | 0.6500  |
| PLANNED TEST TIME                                   | 0.4063  | 0.4063  | 0.4063  | 0.4063  | 3.2504  | 3.2504  | 3.2504  | 3.2504  |
| MCCEL ESTIMATE                                      | 0.5077  | 0.4640  | 0.4844  | 0.4414  | 0.0807  | 0.0547  | 0.0691  | 0.0615  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 26.92   | 16.01   | 21.11   | 10.35   | 61.50   | 5.26    | 10.29   | 7.80    |
| SAMPLE STD DEVIATION                                | 0.3717  | 0.2447  | 0.2372  | 0.2281  | 0.0873  | 0.0250  | 0.0366  | 0.0350  |
| CUMULATIVE TEST TIME                                | 64.569  | 72.051  | 79.547  | 81.057  | 147.563 | 108.236 | 267.136 | 327.873 |
| CUMULATIVE FAILURES                                 | 26.9100 | 29.8600 | 33.1100 | 36.0300 | 38.8700 | 41.9400 | 44.8200 | 47.9000 |





APPENDIX E

Results of Test MOD3

1. Test MOD3

Test MOD3 used the AMSAA model to estimate the failure rate of the items tested except as described below. A more detailed discussion of the modification can be found in Section V-D.

Use of the AMSAA model was modified as follows:

- a. The point estimate of the failure rate,

$$r_p = \frac{\text{number of failures during a phase}}{\text{total test time during a phase}},$$

was used whenever cumulative test time over all items was less than 10 hours.

b. The slope of the reliability growth pattern was estimated using the current point estimate,  $r_p$ , and the two previous estimates of the failure rate,  $\hat{r}_{i-1}$  and  $\hat{r}_{i-2}$ . The slope estimated was in two parts,

$$\hat{r}_{i-1} - \hat{r}_{i-2} \quad \text{and} \quad r_p - \hat{r}_{i-1}.$$

The estimate of the slope was considered increasing if both parts of the estimate were determined to be increasing as follows:



$$\hat{r}_{i-1} - \hat{r}_{i-2} \geq .07$$

and

$$r_p - \hat{r}_{i-1} \geq .07 .$$

If the slope was increasing, the point estimate,  $r_p$ , was used as the current estimate of the failure rate. Then, the AMSAA model was reinitialized, that is, time and failures prior to an increasing slope were not considered in future estimates made by the model.

## 2. The Results

Results for Cases 4, 6, 15, and 18 are presented here as representative of the effect the modifications had on the performance of the model. A detailed description of the format of the results can be found in Appendix A.

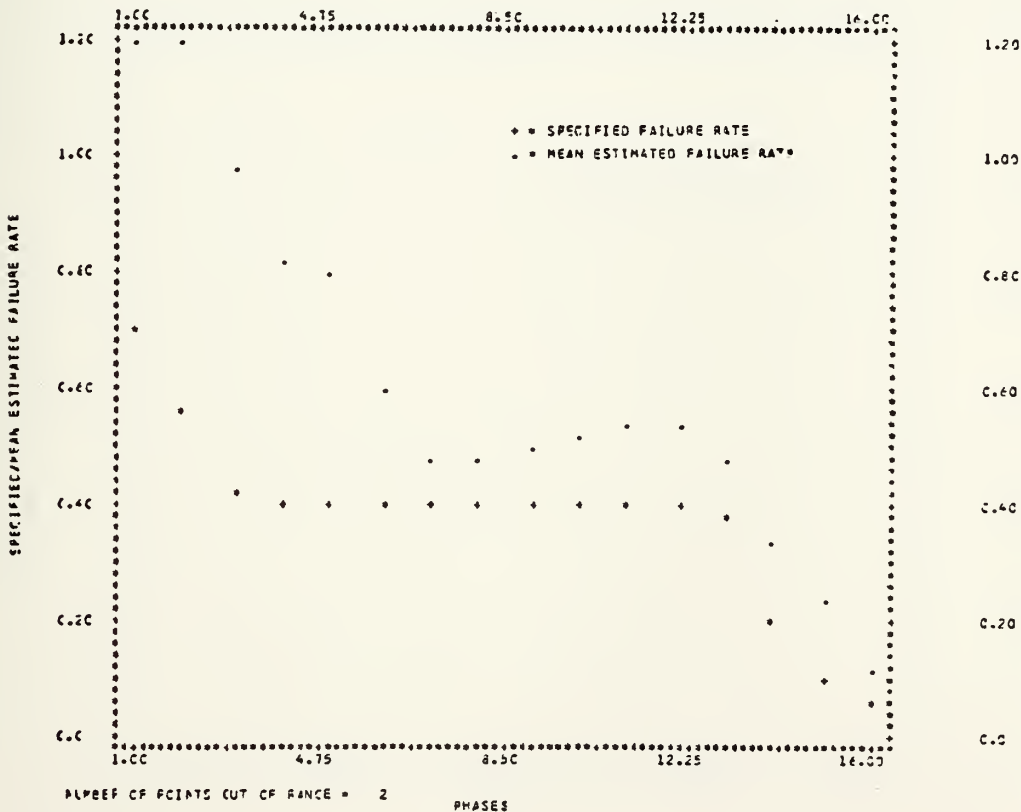


CASE 4

3 STEPS

| PHASE   | 1      | 2      | 3      | 4      | 5      | 6      | 7      | 8      |
|---|--------|--------|--------|--------|--------|--------|--------|--------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.5500 | 0.4250 | 0.4050 | 0.4000 | 0.4000 | 0.4000 | 0.4000 |
| PLANNED TEST TIME                                   | 0.2322 | 0.2555 | 0.3624 | 0.4013 | 0.4063 | 0.4063 | 0.4063 | 0.4063 |
| MODEL ESTIMATE                                      | 1.3264 | 1.2500 | 0.9888 | 0.8127 | 0.8044 | 0.6062 | 0.4842 | 0.4785 |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 89.49  | 134.54 | 132.65 | 100.68 | 101.09 | 51.55  | 21.06  | 15.63  |
| SAMPLE STD DEVIATION                                | 0.6578 | 0.7356 | 0.6517 | 0.4575 | 0.4637 | 0.5258 | 0.3180 | 0.2567 |
| CUMULATIVE TEST TIME                                | 1.074  | 2.418  | 4.202  | 6.009  | 7.942  | 9.843  | 11.657 | 13.580 |
| CUMULATIVE FAILURES                                 | 0.6400 | 1.5100 | 2.0700 | 2.5100 | 3.5500 | 4.2700 | 5.0700 | 5.7700 |

| PHASE   | 9      | 10     | 11     | 12     | 13     | 14      | 15      | 16      |
|---|--------|--------|--------|--------|--------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.4000 | 0.4000 | 0.4000 | 0.4000 | 0.3750 | 0.2000  | 0.1000  | 0.0500  |
| PLANNED TEST TIME                                   | 0.4063 | 0.4063 | 0.4063 | 0.4063 | 0.4334 | 0.8126  | 1.6252  | 3.2504  |
| MODEL ESTIMATE                                      | 0.5034 | 0.5153 | 0.5353 | 0.5432 | 0.4831 | 0.3456  | 0.2457  | 0.1275  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 25.85  | 28.83  | 33.81  | 35.79  | 28.82  | 72.82   | 145.66  | 154.97  |
| SAMPLE STD DEVIATION                                | 0.3057 | 0.3214 | 0.3348 | 0.3906 | 0.3205 | 0.2252  | 0.2752  | 0.0614  |
| CUMULATIVE TEST TIME                                | 19.442 | 17.219 | 19.186 | 21.049 | 23.075 | 26.860  | 34.326  | 45.304  |
| CUMULATIVE FAILURES                                 | 6.5000 | 7.3000 | 8.0700 | 8.3700 | 9.3200 | 10.0800 | 10.8500 | 11.5000 |





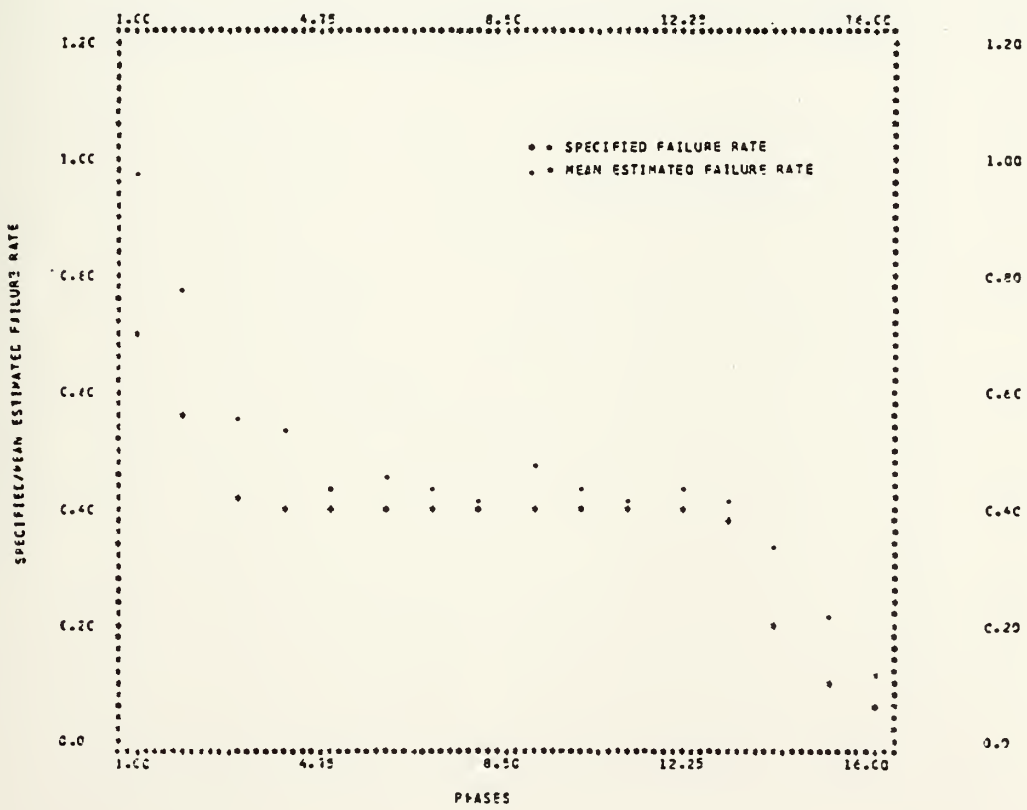


CASE 4

10 ITEMS

| PHASE   | 1      | 2      | 3      | 4      | 5      | 6      | 7       | 8       |
|---|--------|--------|--------|--------|--------|--------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.5000 | 0.4250 | 0.4050 | 0.4000 | 0.4000 | 0.4000  | 0.4000  |
| PLANNED TEST TIME                                   | 0.2322 | 0.2555 | 0.3824 | 0.4013 | 0.4063 | 0.4063 | 0.4063  | 0.4063  |
| MODEL ESTIMATE                                      | 0.9735 | 0.7761 | 0.5674 | 0.5432 | 0.4428 | 0.4551 | 0.4351  | 0.4718  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 39.13  | 41.11  | 33.50  | 34.13  | 10.71  | 13.77  | 9.77    | 9.40    |
| SAMPLE STD DEVIATION                                | 0.6085 | 0.5434 | 0.3315 | 0.5243 | 0.2595 | 0.2514 | 0.2879  | 0.2205  |
| CUMULATIVE TEST TIME                                | 2.136  | 4.687  | 8.462  | 12.133 | 19.883 | 15.633 | 23.410  | 27.195  |
| CUMULATIVE FAILURES                                 | 1.5400 | 2.9400 | 4.1400 | 5.8600 | 7.3100 | 8.6400 | 10.1000 | 11.5000 |

| PHASE   | 9       | 10      | 11      | 12      | 13      | 14      | 15      | 16      |
|---|---------|---------|---------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.4000  | 0.4000  | 0.4000  | 0.4000  | 0.3750  | 0.2000  | 0.1000  | 0.0500  |
| PLANNED TEST TIME                                   | 0.4063  | 0.4063  | 0.4063  | 0.4063  | 0.4334  | 0.8126  | 1.6252  | 3.2504  |
| MODEL ESTIMATE                                      | 0.4859  | 0.4354  | 0.4195  | 0.4398  | 0.4265  | 0.3421  | 0.2276  | 0.1263  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 21.47   | 9.86    | 4.87    | 9.94    | 13.62   | 71.06   | 127.63  | 152.55  |
| SAMPLE STD DEVIATION                                | 0.3973  | 0.2938  | 0.2260  | 0.2441  | 0.1972  | 0.1564  | 0.0938  | 0.0404  |
| CUMULATIVE TEST TIME                                | 20.943  | 34.723  | 38.459  | 42.187  | 46.178  | 53.627  | 68.985  | 98.201  |
| CUMULATIVE FAILURES                                 | 13.0700 | 14.3100 | 16.0100 | 17.5700 | 19.1600 | 20.8000 | 22.3500 | 23.9300 |





| PHASE   | 1      | 2      | 3      | 4       | 5       | 6       | 7       | 8       |
|---|--------|--------|--------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.5300 | 0.4250 | 0.4050  | 0.4000  | 0.4000  | 0.4000  | 0.4000  |
| PLANNED TEST TIME                                   | 0.2322 | 0.2525 | 0.3824 | 0.4013  | 0.4063  | 0.4063  | 0.4063  | 0.4063  |
| MCCEL ESTIMATE                                      | 0.7576 | 0.6289 | 0.4737 | 0.4292  | 0.4348  | 0.4254  | 0.4121  | 0.4230  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 8.23   | 14.25  | 11.47  | 5.98    | 6.71    | 7.25    | 3.03    | 6.25    |
| SAMPLE STD DEVIATION                                | 0.4180 | 0.3568 | 0.2465 | 0.2077  | 0.2363  | 0.2052  | 0.1962  | 0.1784  |
| CUMULATIVE TEST TIME                                | 4.213  | 9.758  | 16.874 | 24.303  | 31.798  | 39.327  | 46.759  | 54.188  |
| CUMULATIVE FAILURES                                 | 2.9000 | 5.6600 | 8.8100 | 11.7100 | 14.7100 | 17.7600 | 20.8300 | 24.0300 |

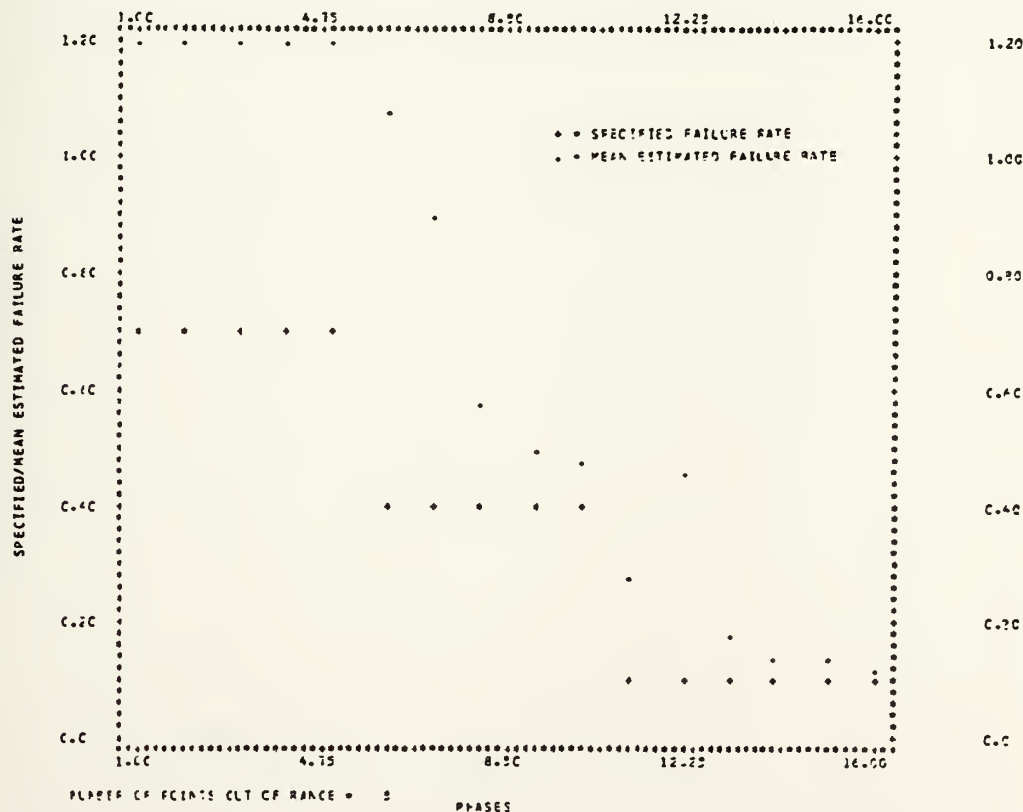
| PHASE   | 9       | 10      | 11      | 12      | 13      | 14      | 15      | 16      |
|---|---------|---------|---------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.4000  | 0.4000  | 0.4000  | 0.4000  | 0.3750  | 0.2000  | 0.1000  | 0.0500  |
| PLANNED TEST TIME                                   | 0.4063  | 0.4063  | 0.4063  | 0.4063  | 0.4334  | 0.8126  | 1.6222  | 3.2904  |
| MCCEL ESTIMATE                                      | 0.4096  | 0.4147  | 0.3936  | 0.3958  | 0.3913  | 0.3106  | 0.2133  | 0.1266  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 2.35    | 4.17    | 1.55    | 1.04    | 4.24    | 22.21   | 115.25  | 152.63  |
| SAMPLE STD DEVIATION                                | 0.1433  | 0.1600  | 0.1282  | 0.1137  | 0.1154  | 0.0529  | 0.0667  | 0.0406  |
| CUMULATIVE TEST TIME                                | 61.676  | 69.133  | 76.672  | 84.172  | 92.154  | 107.154 | 137.320 | 197.432 |
| CUMULATIVE FAILURES                                 | 27.0400 | 30.2200 | 33.2300 | 36.1700 | 39.0600 | 42.0600 | 44.8000 | 47.8000 |





| PHASE   | 1      | 2      | 3      | 4      | 5      | 6      | 7      | 8      |
|---|--------|--------|--------|--------|--------|--------|--------|--------|
| ACTUAL FAILURE RATE                                 | 0.1000 | 0.1000 | 0.7000 | 0.7000 | 0.1000 | 0.4000 | 0.4000 | 0.4000 |
| PLANNED TEST TIME                                   | 0.2322 | 0.2322 | 0.2322 | 0.2322 | 0.2322 | 0.4063 | 0.4063 | 0.4063 |
| MODEL ESTIMATE                                      | 1.3652 | 1.4414 | 1.3728 | 1.4248 | 1.3555 | 1.0810 | 0.9029 | 0.9721 |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 95.03  | 105.51 | 96.11  | 103.54 | 92.64  | 110.54 | 122.12 | 132.21 |
| SAMPLE STD DEVIATION                                | 0.6434 | 0.8235 | 0.7410 | 0.7812 | 0.6901 | 0.7164 | 0.6225 | 0.2965 |
| CUMULATIVE TEST TIME                                | 1.061  | 2.128  | 3.209  | 4.305  | 5.374  | 7.510  | 9.675  | 10.568 |
| CUMULATIVE FAILURES                                 | 0.7400 | 1.4500 | 2.2200 | 2.8400 | 3.2500 | 4.4300 | 5.2500 | 6.0100 |

| PHASE   | 9      | 10     | 11     | 12     | 13     | 14      | 15      | 16      |
|---|--------|--------|--------|--------|--------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.4000 | 0.4000 | 0.1000 | 0.1000 | 0.1000 | 0.1000  | 0.1000  | 0.1000  |
| PLANNED TEST TIME                                   | 0.4063 | 0.4063 | 1.6252 | 1.6252 | 1.6252 | 1.6252  | 1.6252  | 1.6252  |
| MODEL ESTIMATE                                      | 0.5058 | 0.4751 | 0.2701 | 0.4624 | 0.1733 | 0.1458  | 0.1340  | 0.1231  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 27.46  | 18.77  | 170.15 | 162.27 | 72.25  | 42.78   | 32.56   | 23.06   |
| SAMPLE STD DEVIATION                                | 0.2718 | 0.2446 | 0.1674 | 2.5930 | 0.1390 | 0.1051  | 0.0751  | 0.0545  |
| CUMULATIVE TEST TIME                                | 12.656 | 14.742 | 22.241 | 59.722 | 37.201 | 44.676  | 52.044  | 59.923  |
| CUMULATIVE FAILURES                                 | 6.6800 | 7.3800 | 7.9800 | 8.9000 | 9.7000 | 10.4000 | 11.3000 | 12.1000 |

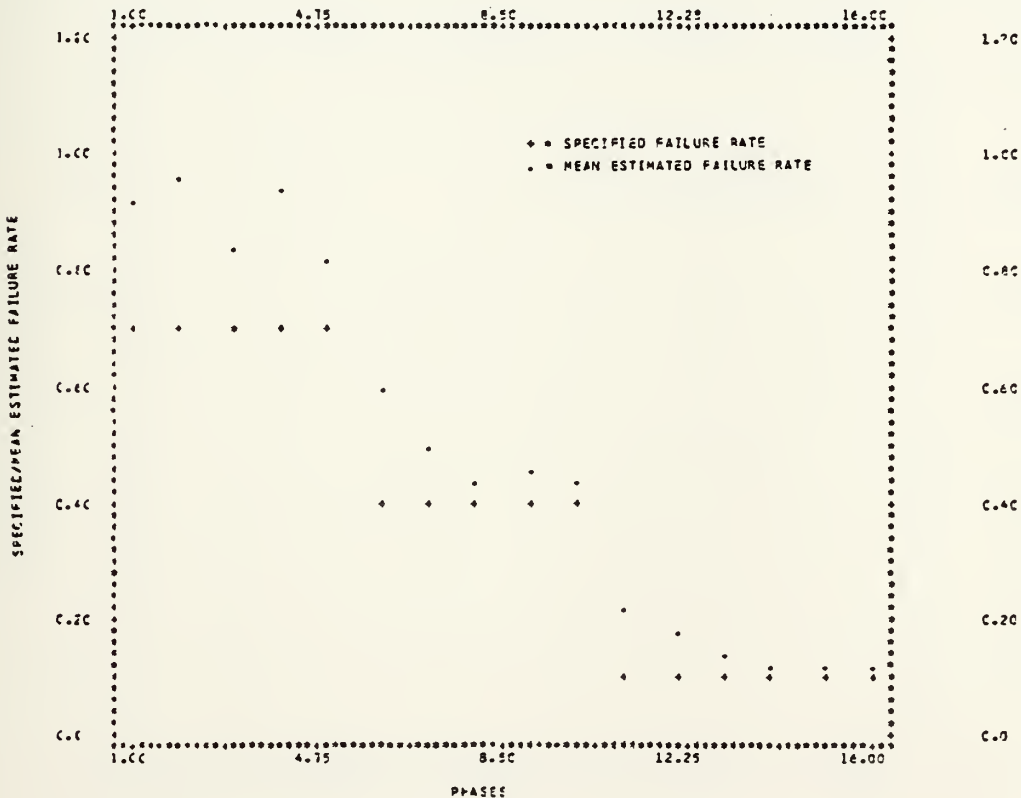




| PHASE   | 1      | 2      | 3      | 4      | 5      | 6      | 7      | 8       |
|---|--------|--------|--------|--------|--------|--------|--------|---------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.7000 | 0.7000 | 0.7000 | 0.7000 | 0.4000 | 0.4000 | 0.4000  |
| PLANNED TEST TIME                                   | 0.2322 | 0.2322 | 0.2322 | 0.2322 | 0.2322 | 0.4063 | 0.4063 | 0.4063  |
| MODEL ESTIMATE                                      | 0.9152 | 0.9550 | 0.8363 | 0.9337 | 0.8286 | 0.6061 | 0.5078 | 0.4483  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 31.32  | 37.00  | 19.48  | 33.38  | 18.37  | 31.53  | 26.95  | 12.08   |
| SAMPLE STD DEVIATION                                | 0.5075 | 0.5522 | 0.4067 | 0.4841 | 0.4354 | 0.3851 | 0.3397 | 0.2194  |
| CUMULATIVE TEST TIME                                | 2.158  | 4.277  | 6.441  | 8.553  | 10.725 | 14.459 | 18.287 | 22.093  |
| CUMULATIVE FAILURES                                 | 1.3500 | 3.0100 | 4.3200 | 5.6200 | 7.1800 | 8.6600 | 9.9800 | 11.2500 |

.....

| PHASE   | 9       | 10      | 11      | 12      | 13      | 14      | 15      | 16      |
|---|---------|---------|---------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.4000  | 0.4000  | 0.1000  | 0.1000  | 0.1000  | 0.1000  | 0.1000  | 0.1000  |
| PLANNED TEST TIME                                   | 0.4063  | 0.4063  | 1.6252  | 1.6252  | 1.6252  | 1.6252  | 1.6252  | 1.6252  |
| MODEL ESTIMATE                                      | 0.4653  | 0.4462  | 0.2259  | 0.1702  | 0.1426  | 0.1266  | 0.1167  | 0.1107  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 17.32   | 11.54   | 125.95  | 70.15   | 42.63   | 26.58   | 16.68   | 10.70   |
| SAMPLE STD DEVIATION                                | 0.2712  | 0.2156  | 0.0906  | 0.0626  | 0.0517  | 0.0458  | 0.0357  | 0.0295  |
| CUMULATIVE TEST TIME                                | 25.831  | 29.965  | 44.552  | 55.418  | 74.438  | 85.320  | 104.331 | 115.306 |
| CUMULATIVE FAILURES                                 | 12.7500 | 14.1500 | 15.7600 | 17.4500 | 19.0200 | 20.5600 | 22.1800 | 23.7400 |

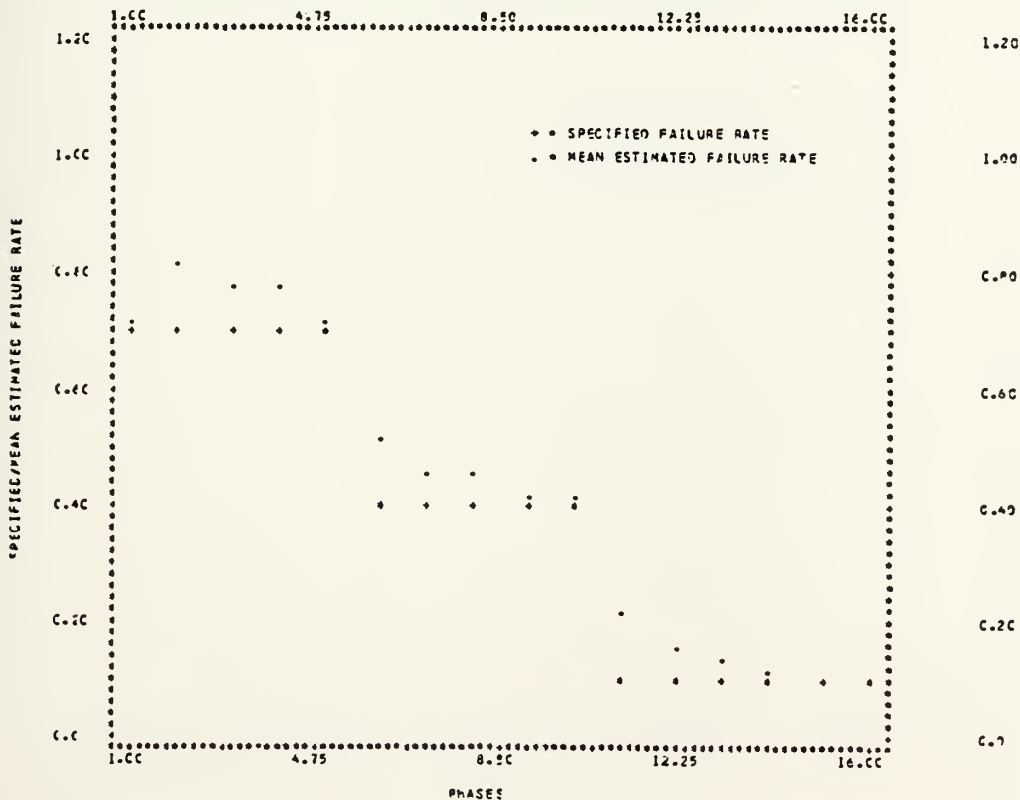






| PHASE   | 1      | 2      | 3      | 4       | 5       | 6       | 7       | 8       |
|---|--------|--------|--------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.7000 | 0.7000 | 0.7000  | 0.7000  | 0.4000  | 0.4000  | 0.4000  |
| PLANNED TEST TIME                                   | 0.2322 | 0.2322 | 0.2322 | 0.2322  | 0.2322  | 0.4063  | 0.4063  | 0.4063  |
| MCCEL ESTIMATE                                      | 0.7251 | 0.8111 | 0.7828 | 0.7842  | 0.7198  | 0.9260  | 0.4616  | 0.4936  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 3.58   | 15.86  | 11.83  | 12.02   | 2.82    | 31.49   | 15.35   | 13.40   |
| SAMPLE STD DEVIATION                                | 0.4067 | 0.4101 | 0.3489 | 0.3558  | 0.3222  | 0.2321  | 0.1617  | 0.1604  |
| CUMULATIVE TEST TIME                                | 4.254  | 8.561  | 12.842 | 17.130  | 21.419  | 26.505  | 36.410  | 43.831  |
| CUMULATIVE FAILURES                                 | 2.7700 | 6.0000 | 9.2000 | 12.3000 | 15.2100 | 17.6000 | 21.0000 | 24.0000 |

| PHASE   | 9       | 10      | 11      | 12      | 13      | 14      | 15      | 16      |
|---|---------|---------|---------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.4000  | 0.4000  | 0.1000  | 0.1000  | 0.1000  | 0.1000  | 0.1000  | 0.1000  |
| PLANNED TEST TIME                                   | 0.4063  | 0.4063  | 1.6252  | 1.6252  | 1.6252  | 1.6252  | 1.6252  | 1.6252  |
| MCCEL ESTIMATE                                      | 0.4173  | 0.4176  | 0.2115  | 0.1607  | 0.1338  | 0.1181  | 0.1081  | 0.1009  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 4.33    | 4.39    | 111.52  | 60.74   | 33.84   | 16.06   | 8.05    | 0.94    |
| SAMPLE STD DEVIATION                                | 0.1407  | 0.1426  | 0.0741  | 0.0457  | 0.0335  | 0.0273  | 0.0235  | 0.0204  |
| CUMULATIVE TEST TIME                                | 51.373  | 58.856  | 88.818  | 116.457 | 148.459 | 176.915 | 206.945 | 238.637 |
| CUMULATIVE FAILURES                                 | 27.0300 | 30.0600 | 33.1700 | 36.4600 | 39.4300 | 42.3000 | 45.2600 | 48.2700 |



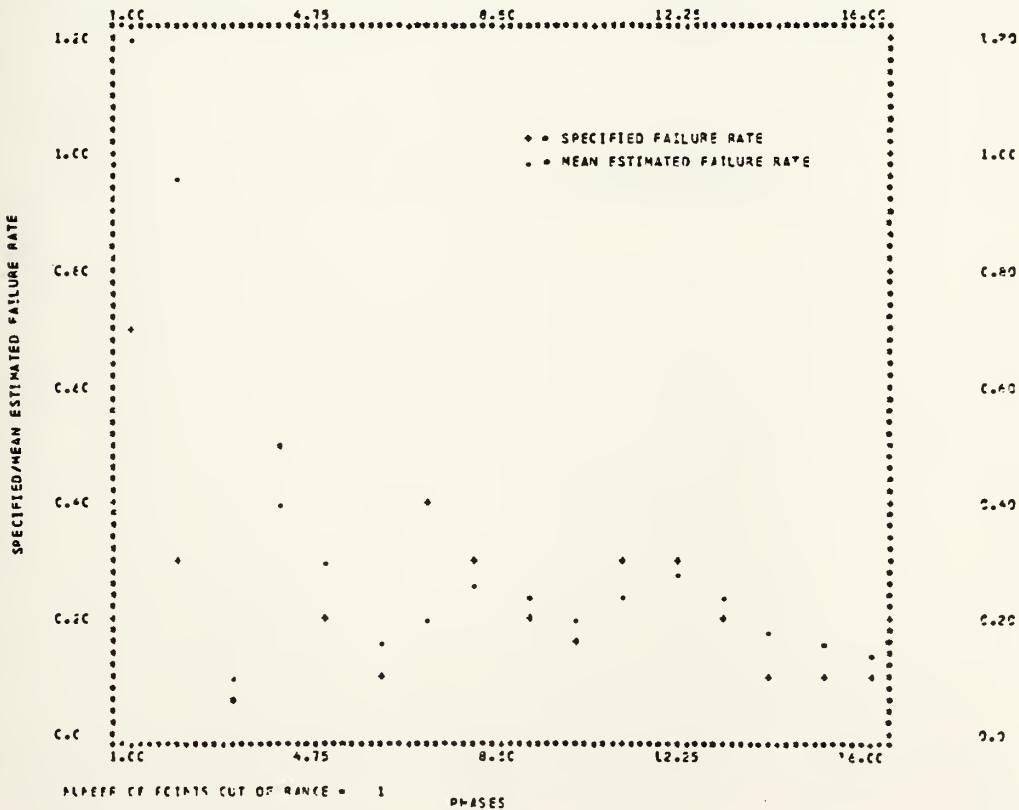


CASE 15

5 ITEMS

| PHASE   | 1      | 2      | 3      | 4      | 5      | 6      | 7      | 8      |
|---|--------|--------|--------|--------|--------|--------|--------|--------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.3000 | 0.0500 | 0.5000 | 0.2000 | 0.1000 | 0.4000 | 0.3000 |
| PLANNED TEST TIME                                   | 0.2222 | 0.5417 | 3.2504 | 0.3750 | 0.8126 | 1.6252 | 0.4062 | 0.5417 |
| MCCREL ESTIMATE                                     | 1.5230 | 0.5539 | 0.1074 | 0.4027 | 0.2542 | 0.1274 | 0.1924 | 0.2619 |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 117.57 | 217.57 | 114.79 | 19.47  | 47.10  | 57.40  | 51.89  | 12.70  |
| SAMPLE STD DEVIATION                                | 1.0053 | 0.8239 | 0.1107 | 0.7404 | 0.3842 | 0.1725 | 0.1969 | 0.3440 |
| CUMULATIVE TEST TIME                                | 1.074  | 3.273  | 18.481 | 19.990 | 23.722 | 31.225 | 32.112 | 39.575 |
| CUMULATIVE FAILURES                                 | 0.7000 | 1.5200 | 2.2500 | 2.9500 | 2.7200 | 4.4500 | 5.0700 | 5.9300 |

| PHASE   | 9      | 10     | 11     | 12     | 13     | 14      | 15      | 16      |
|---|--------|--------|--------|--------|--------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.2000 | 0.1500 | 0.5000 | 0.3000 | 0.2000 | 0.1000  | 0.1000  | 0.1000  |
| PLANNED TEST TIME                                   | 0.8126 | 1.0025 | 0.5417 | 0.5417 | 0.8126 | 1.6252  | 1.6252  | 1.6252  |
| MCCREL ESTIMATE                                     | 0.2333 | 0.1528 | 0.2456 | 0.2727 | 0.2405 | 0.1834  | 0.1916  | 0.1314  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 16.63  | 28.51  | 18.13  | 9.09   | 20.47  | 83.40   | 31.75   | 31.43   |
| SAMPLE STD DEVIATION                                | 0.2264 | 0.1616 | 0.2581 | 0.2766 | 0.2453 | 0.1255  | 0.0557  | 0.0611  |
| CUMULATIVE TEST TIME                                | 39.251 | 44.288 | 46.766 | 49.254 | 23.005 | 60.484  | 68.051  | 75.725  |
| CUMULATIVE FAILURES                                 | 6.5100 | 7.2200 | 8.3100 | 9.1000 | 9.8100 | 10.7100 | 11.3900 | 11.9500 |



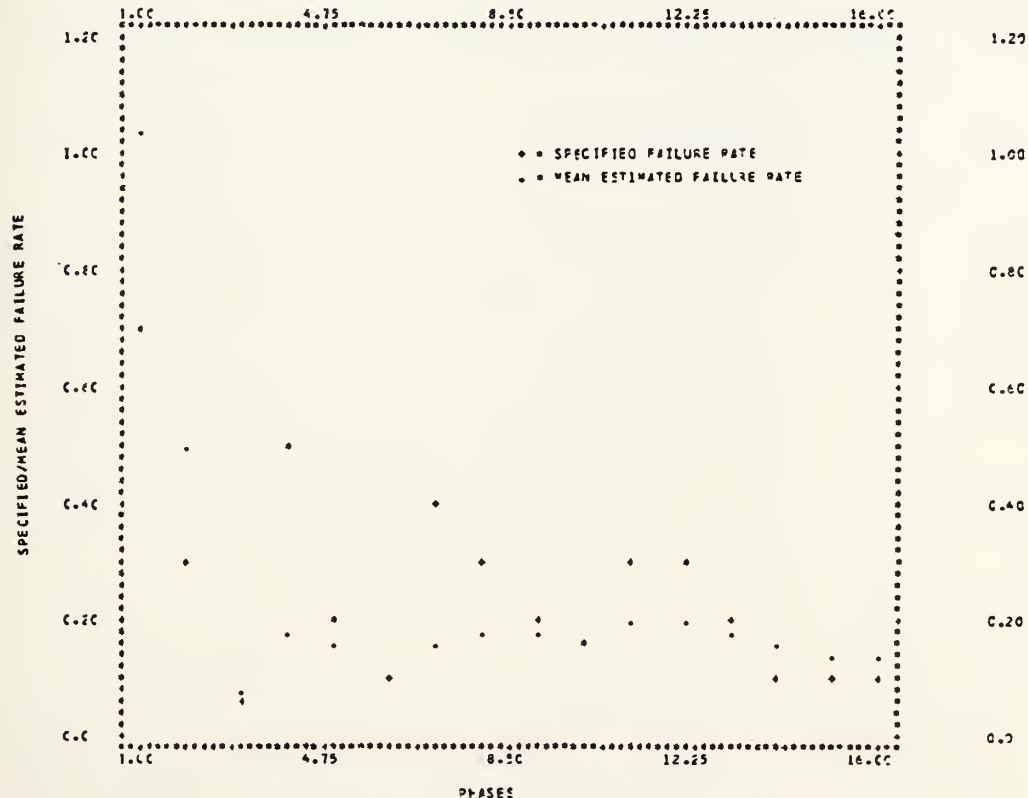


CASE 15

10 ITEMS

| PHASE   | 1      | 2      | 3      | 4      | 5      | 6      | 7       | 8       |
|---|--------|--------|--------|--------|--------|--------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.3000 | 0.0500 | 0.5000 | 0.2000 | 0.1000 | 0.4000  | 0.3000  |
| FLANEC TEST TIME                                    | 0.2322 | 0.5417 | 3.2504 | 0.3250 | 0.8126 | 1.6252 | 0.4063  | 0.5417  |
| MCEL ESTIMATE                                       | 1.0292 | 0.5081 | 0.0843 | 0.1876 | 0.1503 | 0.1072 | 0.1500  | 0.1721  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 48.46  | 65.26  | 68.63  | 62.49  | 24.95  | 7.18   | 62.49   | 42.64   |
| SAMPLE STD DEVIATION                                | 0.5388 | 0.3629 | 0.1227 | 0.3933 | 0.1465 | 0.0610 | 0.1129  | 0.1137  |
| CUMULATIVE TEST TIME                                | 2.104  | 7.083  | 37.101 | 40.105 | 47.606 | 62.976 | 66.304  | 71.262  |
| CUMULATIVE FAILURES                                 | 1.7700 | 3.3500 | 4.8500 | 4.3500 | 7.5200 | 5.3600 | 10.9800 | 12.5900 |

| PHASE   | 9       | 10      | 11      | 12      | 13      | 14      | 15      | 16      |
|---|---------|---------|---------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.2000  | 0.1500  | 0.3000  | 0.3000  | 0.2000  | 0.1000  | 0.1000  | 0.1000  |
| FLANEC TEST TIME                                    | 0.8126  | 1.0255  | 0.5417  | 0.5417  | 0.8126  | 1.6252  | 1.6252  | 1.6252  |
| MCEL ESTIMATE                                       | 0.1801  | 0.1664  | 0.1985  | 0.1981  | 0.1861  | 0.1564  | 0.1447  | 0.1338  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 9.93    | 10.93   | 33.85   | 33.96   | 6.94    | 58.38   | 44.71   | 33.81   |
| SAMPLE STD DEVIATION                                | 0.1424  | 0.1103  | 0.1573  | 0.1275  | 0.0857  | 0.0606  | 0.0531  | 0.0473  |
| CUMULATIVE TEST TIME                                | 78.788  | 88.725  | 93.707  | 98.702  | 106.248 | 121.305 | 136.297 | 151.152 |
| CUMULATIVE FAILURES                                 | 13.9900 | 15.5700 | 17.1800 | 18.6800 | 20.1100 | 21.6400 | 23.2900 | 24.8700 |



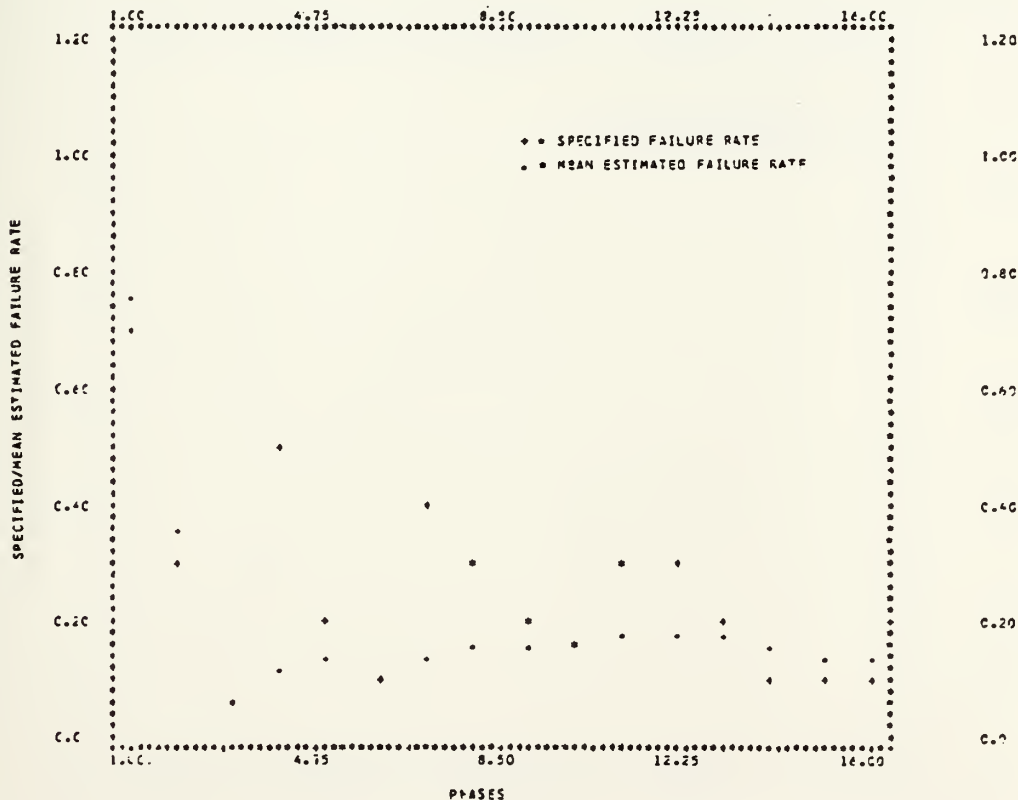


CASE 15

20 ITEMS

| PHASE   | 1      | 2      | 3      | 4       | 5       | 6       | 7       | 8       |
|---|--------|--------|--------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.3000 | 0.0500 | 0.5000  | 0.2000  | 0.1000  | 0.4000  | 0.7000  |
| PLANNED TEST TIME                                   | 0.2322 | 0.5417 | 3.2504 | 0.3250  | 0.8126  | 1.6252  | 0.4062  | 0.5417  |
| POCEL ESTIMATE                                      | 0.7622 | 0.3512 | 0.0627 | 0.1195  | 0.1367  | 0.1065  | 0.1424  | 0.1673  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 8.89   | 17.05  | 25.32  | 76.02   | 31.66   | 6.24    | 64.19   | 44.22   |
| SAMPLE STD DEVIATION                                | 0.4205 | 0.1582 | 0.0377 | 0.2004  | 0.1081  | 0.0469  | 0.0840  | 0.0504  |
| CUMULATIVE TEST TIME                                | 4.272  | 14.268 | 74.066 | 60.098  | 55.034  | 124.911 | 122.346 | 142.276 |
| CUMULATIVE FAILURES                                 | 2.9500 | 5.8500 | 9.0000 | 11.7600 | 14.8800 | 18.0500 | 21.3200 | 24.4500 |

| PHASE   | 9       | 10      | 11      | 12      | 13      | 14      | 15      | 16      |
|---|---------|---------|---------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.2000  | 0.1500  | 0.3000  | 0.3000  | 0.2000  | 0.1000  | 0.1000  | 0.1000  |
| PLANNED TEST TIME                                   | 0.8126  | 1.0835  | 0.5417  | 0.5417  | 0.8126  | 1.6252  | 1.6252  | 1.6252  |
| POCEL ESTIMATE                                      | 0.1652  | 0.1573  | 0.1769  | 0.1884  | 0.1869  | 0.1642  | 0.1475  | 0.1370  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 19.41   | 4.89    | 41.05   | 37.19   | 4.59    | 64.17   | 47.93   | 37.04   |
| SAMPLE STD DEVIATION                                | 0.0510  | 0.0606  | 0.0696  | 0.0683  | 0.0616  | 0.0454  | 0.0363  | 0.0320  |
| CUMULATIVE TEST TIME                                | 157.243 | 177.242 | 187.247 | 197.196 | 212.194 | 242.173 | 272.258 | 302.306 |
| CUMULATIVE FAILURES                                 | 27.4000 | 30.4000 | 33.4100 | 36.6600 | 39.6100 | 42.6600 | 45.4900 | 48.4300 |





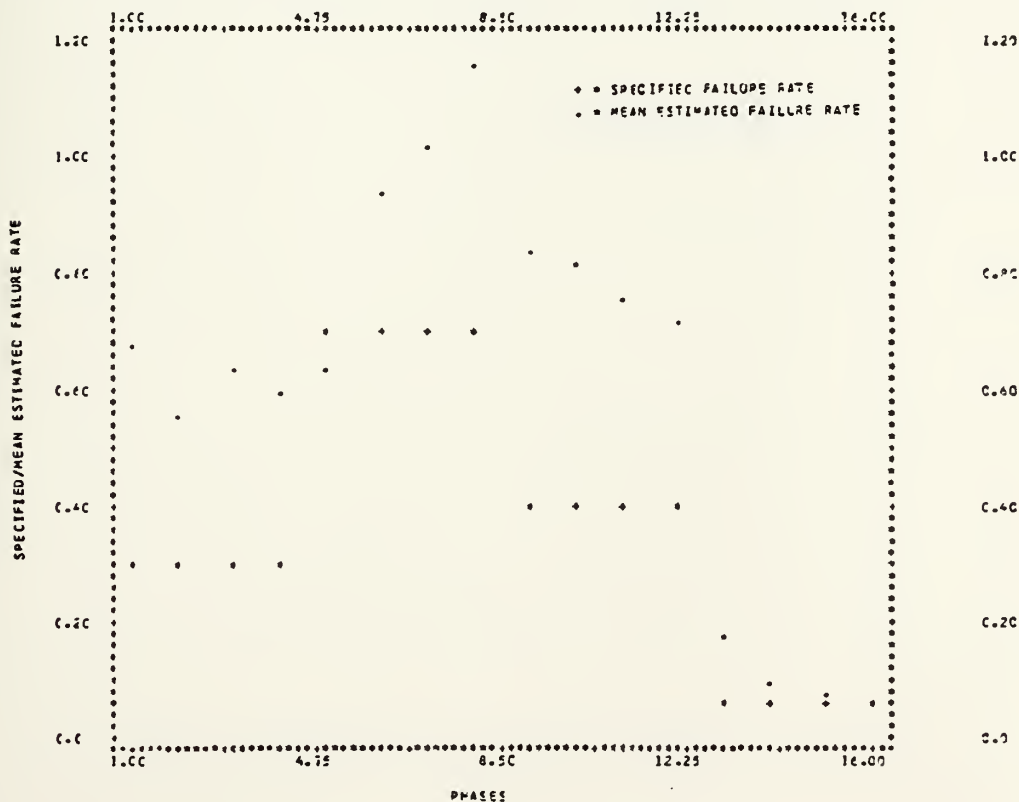


CASE 18

5 STEPS

| PHASE   | 1      | 2      | 3      | 4      | 5      | 6      | 7      | 8      |
|---|--------|--------|--------|--------|--------|--------|--------|--------|
| ACTUAL FAILURE RATE                                 | 0.3000 | 0.3000 | 0.3000 | 0.3000 | 0.1000 | 0.1000 | 0.1000 | 0.1000 |
| PLANNED TEST TIME                                   | 0.5417 | 0.5417 | 0.5417 | 0.5417 | 0.2322 | 0.2322 | 0.2227 | 0.2327 |
| MODEL ESTIMATE                                      | 0.6856 | 0.5667 | 0.6452 | 0.5939 | 0.6399 | 0.5478 | 1.0287 | 1.1195 |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 128.55 | 88.50  | 115.06 | 97.97  | 8.59   | 22.40  | 46.56  | 62.64  |
| SAMPLE STD DEVIATION                                | 0.2824 | 0.3011 | 0.3277 | 0.4844 | 0.7454 | 0.8115 | 0.7523 | 0.8855 |
| CUMULATIVE TEST TIME                                | 2.505  | 5.042  | 7.507  | 10.020 | 11.115 | 12.158 | 13.223 | 14.288 |
| CUMULATIVE FAILURES                                 | 0.7100 | 1.4200 | 2.2600 | 3.0000 | 3.4200 | 4.4700 | 5.0300 | 5.5100 |

| PHASE   | 9      | 10     | 11     | 12     | 13     | 14      | 15      | 16      |
|---|--------|--------|--------|--------|--------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.4000 | 0.4000 | 0.4000 | 0.4000 | 0.0500 | 0.0500  | 0.0500  | 0.0500  |
| PLANNED TEST TIME                                   | 0.4063 | 0.4063 | 0.4063 | 0.4063 | 3.2504 | 3.2504  | 3.2504  | 3.2504  |
| MODEL ESTIMATE                                      | 0.8375 | 0.8254 | 0.7519 | 0.7293 | 0.1743 | 0.1005  | 0.0784  | 0.0604  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 109.37 | 107.36 | 87.58  | 80.82  | 248.68 | 101.05  | 56.88   | 20.81   |
| SAMPLE STD DEVIATION                                | 0.6796 | 0.6606 | 0.6110 | 0.5380 | 0.1542 | 0.0659  | 0.0513  | 0.0282  |
| CUMULATIVE TEST TIME                                | 16.166 | 18.057 | 19.541 | 21.004 | 26.765 | 51.570  | 67.164  | 82.335  |
| CUMULATIVE FAILURES                                 | 6.8200 | 7.5200 | 8.2700 | 8.9800 | 9.5200 | 10.4800 | 11.2000 | 11.5100 |





CASE 10

10 ITEMS

| PHASE   | 1      | 2      | 3      | 4      | 5      | 6      | 7       | 8       |
|---|--------|--------|--------|--------|--------|--------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.3000 | 0.3000 | 0.3000 | 0.3000 | 0.7000 | 0.7000 | 0.7000  | 0.7000  |
| PLANNED TEST TIME                                   | 0.5417 | 0.5417 | 0.5417 | 0.5417 | 0.2322 | 0.2322 | 0.2322  | 0.2322  |
| MODEL ESTIMATE                                      | 0.4091 | 0.3816 | 0.4460 | 0.4523 | 0.6225 | 0.6765 | 0.7650  | 0.8337  |
| ESTIMATE EFFCR AS PERCENTAGE OF ACTUAL FAILURE RATE | 36.2E  | 27.19  | 48.68  | 50.77  | 11.07  | 2.21   | 5.66    | 15.10   |
| SAMPLE STC DEVIATION                                | 0.2150 | 0.2724 | 0.3171 | 0.2569 | 0.4405 | 0.4193 | 0.5224  | 0.4772  |
| CUMULATIVE TEST TIME                                | 4.527  | 9.532  | 14.858 | 19.747 | 21.905 | 24.061 | 26.213  | 28.341  |
| CUMULATIVE FAILURES                                 | 1.5500 | 3.0400 | 4.7600 | 6.5600 | 7.9700 | 9.1400 | 10.6600 | 12.4700 |

| PHASE   | 9       | 10      | 11      | 12      | 13      | 14      | 15      | 16      |
|---|---------|---------|---------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.4000  | 0.4000  | 0.4000  | 0.4000  | 0.6500  | 0.6500  | 0.6500  | 0.6500  |
| PLANNED TEST TIME                                   | 0.4063  | 0.4063  | 0.4063  | 0.4063  | 3.2504  | 3.2504  | 3.2504  | 3.2504  |
| MODEL ESTIMATE                                      | 0.5821  | 0.4701  | 0.4579  | 0.4509  | 0.1327  | 0.0862  | 0.0678  | 0.0588  |
| ESTIMATE EFFCR AS PERCENTAGE OF ACTUAL FAILURE RATE | 45.54   | 17.53   | 14.46   | 12.74   | 189.46  | 72.45   | 29.66   | 17.67   |
| SAMPLE STC DEVIATION                                | 0.3305  | 0.1858  | 0.2051  | 0.2147  | 0.0628  | 0.0355  | 0.0283  | 0.0224  |
| CUMULATIVE TEST TIME                                | 32.125  | 35.950  | 39.705  | 43.455  | 73.610  | 103.734 | 133.795 | 163.986 |
| CUMULATIVE FAILURES                                 | 13.8200 | 15.0600 | 16.5500 | 18.0700 | 19.4800 | 20.8400 | 22.3300 | 23.8700 |





CASE 18

20 ITEMS

| PHASE   | 1      | 2      | 3      | 4       | 5       | 6       | 7       | 8       |
|---|--------|--------|--------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.3000 | 0.3000 | 0.3000 | 0.3000  | 0.7000  | 0.7000  | 0.7000  | 0.7000  |
| PLANNED TEST TIME                                   | 0.5417 | 0.5417 | 0.5417 | 0.5417  | 0.2322  | 0.2322  | 0.2322  | 0.2322  |
| MDEL ESTIMATE                                       | 0.4185 | 0.3643 | 0.3517 | 0.3462  | 0.4536  | 0.6321  | 0.6954  | 0.6663  |
| ESTIMATE EFFCR AS PERCENTAGE OF ACTUAL FAILURE RATE | 39.45  | 21.43  | 30.58  | 15.35   | 25.45   | 9.70    | 0.08    | 1.56    |
| SAMPLE STD DEVIATION                                | 0.2505 | 0.2188 | 0.3011 | 0.1619  | 0.2950  | 0.3162  | 0.3562  | 0.3326  |
| CUMULATIVE TEST TIME                                | 9.556  | 19.566 | 25.890 | 35.508  | 44.206  | 46.478  | 52.744  | 57.035  |
| CUMULATIVE FAILURES                                 | 3.0300 | 5.5000 | 5.1000 | 12.0600 | 14.5400 | 18.1200 | 21.0300 | 23.5500 |

| PHASE   | 9       | 10      | 11      | 12      | 13      | 14      | 15      | 16      |
|---|---------|---------|---------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.4000  | 0.4000  | 0.4000  | 0.4000  | 0.0500  | 0.0500  | 0.0500  | 0.0500  |
| PLANNED TEST TIME                                   | 0.4063  | 0.4063  | 0.4063  | 0.4063  | 3.2504  | 3.2504  | 3.2504  | 3.2504  |
| MDEL ESTIMATE                                       | 0.5218  | 0.4624  | 0.4861  | 0.4394  | 0.1257  | 0.0754  | 0.0642  | 0.0553  |
| ESTIMATE EFFCR AS PERCENTAGE OF ACTUAL FAILURE RATE | 39.44   | 15.60   | 21.53   | 9.86    | 155.32  | 58.85   | 28.34   | 10.51   |
| SAMPLE STD DEVIATION                                | 0.2717  | 0.2251  | 0.2259  | 0.1740  | 0.0792  | 0.0341  | 0.0242  | 0.0183  |
| CUMULATIVE TEST TIME                                | 64.565  | 72.051  | 79.547  | 87.097  | 147.563 | 206.236 | 267.136 | 327.623 |
| CUMULATIVE FAILURES                                 | 26.9700 | 29.8600 | 33.1100 | 36.0300 | 26.5000 | 41.5400 | 44.6200 | 47.9000 |





## APPENDIX F

### Results of Test MOD4

#### 1. Test MOD4

Test MOD4 used the AMSAA model to estimate the failure rate of the items tested except as described below. A more detailed discussion of the modification can be found in Section V-D.

Use of the AMSAA model was modified as follows:

a. The point estimate of the failure rate,

$$r_p = \frac{\text{number of failures during a phase}}{\text{total test time during a phase}},$$

was used whenever cumulative test time over all items was less than 10 hours.

b. The slope of the reliability growth pattern was estimated using the current point estimate,  $r_p$ , and the previous estimates of the failure rate,  $\hat{r}_{i-1}$  and  $\hat{r}_{i-2}$ . The slope estimated was in two parts,

$$\hat{r}_{i-1} - \hat{r}_{i-2} \quad \text{and} \quad r_p - \hat{r}_{i-1}.$$

The estimate of the slope was considered increasing if both parts of the estimate were determined to be increasing as follows:





$$\hat{r}_{i-1} - \hat{r}_{i-2} \geq .2\hat{r}_{i-2}$$

and

$$r_p - \hat{r}_{i-1} \geq .2\hat{r}_{i-1} .$$

If the slope was increasing, the point estimate,  $r_p$ , was used as the current estimate of the failure rate. Then, the AMSAA model was reinitialized, that is, time and failures prior to an increasing slope were not considered in future estimates made by the model.

## 2. The Results

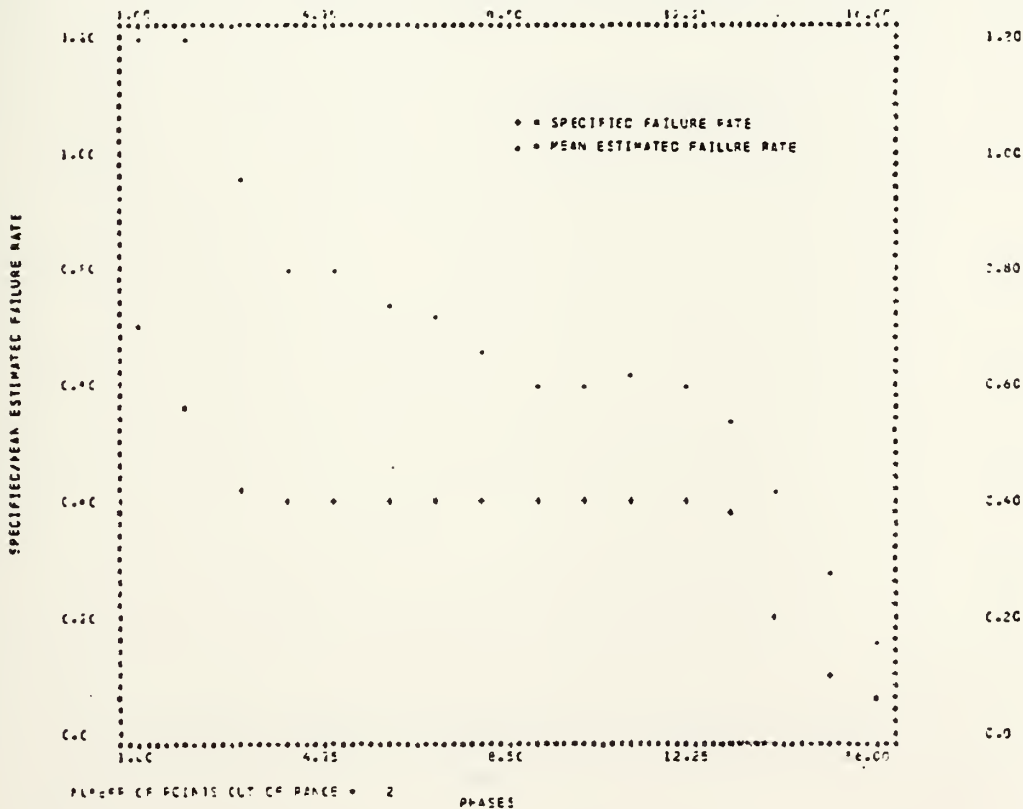
Results for Cases 4, 6, 15, and 18 are presented here as representative of the effect the modifications had on the performance of the model. A detailed description of the format of the results can be found in Appendix A.



5 ITEMS

| PHASE   | 1      | 2      | 3      | 4      | 5      | 6      | 7      | 8      |
|---|--------|--------|--------|--------|--------|--------|--------|--------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.5200 | 0.4250 | 0.4050 | 0.4000 | 0.4000 | 0.4000 | 0.4000 |
| PLANNED TEST TIME                                   | 0.2322 | 0.2555 | 0.3024 | 0.4013 | 0.4063 | 0.4063 | 0.4063 | 0.4063 |
| MCCEL ESTIMATE                                      | 1.3264 | 1.3166 | 0.9675 | 0.8075 | 0.6067 | 0.7440 | 0.7156 | 0.6506 |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 65.45  | 135.74 | 127.64 | 59.37  | 101.68 | 86.01  | 75.65  | 62.66  |
| SAMPLE STD DEVIATION                                | 0.6578 | 0.7415 | 0.6545 | 0.4593 | 0.4655 | 0.4814 | 0.5557 | 0.4663 |
| CUMULATIVE TEST TIME                                | 1.074  | 2.418  | 4.202  | 6.045  | 7.942  | 9.843  | 11.657 | 13.580 |
| CUMULATIVE FAILURES                                 | 0.6400 | 1.4000 | 2.0500 | 2.8900 | 3.5500 | 4.2300 | 5.0400 | 5.7700 |

| PHASE   | 9      | 10     | 11     | 12     | 13     | 14      | 15      | 16      |
|---|--------|--------|--------|--------|--------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.4000 | 0.4000 | 0.4000 | 0.4000 | 0.3750 | 0.2000  | 0.1000  | 0.0500  |
| PLANNED TEST TIME                                   | 0.4063 | 0.4063 | 0.4063 | 0.4063 | 0.4334 | 0.6126  | 1.6252  | 3.2504  |
| MCCEL ESTIMATE                                      | 0.6016 | 0.6015 | 0.6177 | 0.5977 | 0.5446 | 0.4120  | 0.2700  | 0.1922  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 50.41  | 50.37  | 54.43  | 45.43  | 45.24  | 106.01  | 170.01  | 206.46  |
| SAMPLE STD DEVIATION                                | 0.3664 | 0.2962 | 0.3634 | 0.3770 | 0.3406 | 0.2973  | 0.2077  | 0.1437  |
| CUMULATIVE TEST TIME                                | 15.442 | 17.215 | 19.166 | 21.045 | 23.075 | 26.660  | 34.326  | 45.704  |
| CUMULATIVE FAILURES                                 | 6.5800 | 7.2600 | 8.0000 | 8.6900 | 9.2300 | 10.0100 | 10.9500 | 11.6400 |



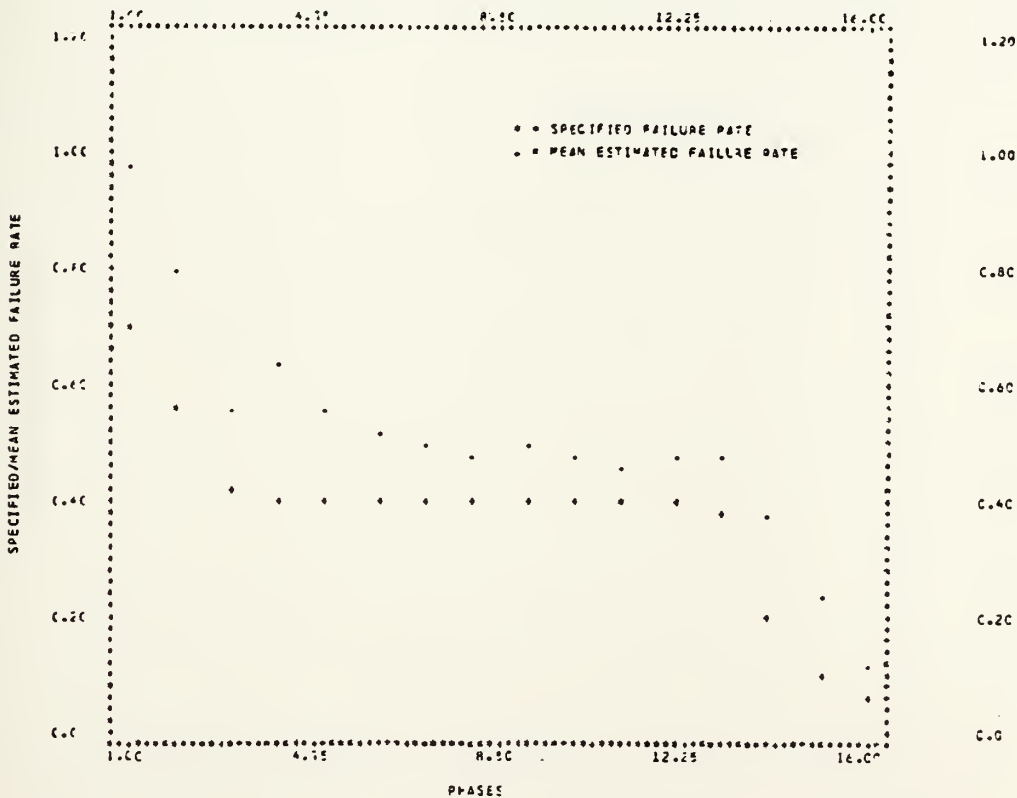


CASE 4

10 ITEMS

| PHASE   | 1      | 2      | 3      | 4      | 5      | 6      | 7       | 8       |
|---|--------|--------|--------|--------|--------|--------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.5100 | 0.4250 | 0.4050 | 0.4000 | 0.4000 | 0.4000  | 0.4000  |
| PLANNED TEST TIME                                   | 0.2322 | 0.2455 | 0.3624 | 0.4013 | 0.4063 | 0.4063 | 0.4063  | 0.4063  |
| POCEL ESTIMATE                                      | 0.9739 | 0.7946 | 0.5631 | 0.6317 | 0.5626 | 0.5103 | 0.4937  | 0.4724  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 39.13  | 44.48  | 32.50  | 55.97  | 40.65  | 27.59  | 23.47   | 18.75   |
| SAMPLE STD DEVIATION                                | 0.6085 | 0.2476 | 0.3205 | 0.6257 | 0.4219 | 0.3326 | 0.3259  | 0.2206  |
| CUMULATIVE TEST TIME                                | 2.136  | 4.667  | 8.462  | 12.133 | 15.883 | 19.633 | 23.410  | 27.999  |
| CUMULATIVE FAILURES                                 | 1.5400 | 2.8100 | 4.1100 | 5.9000 | 7.3100 | 8.6400 | 10.0000 | 11.2700 |

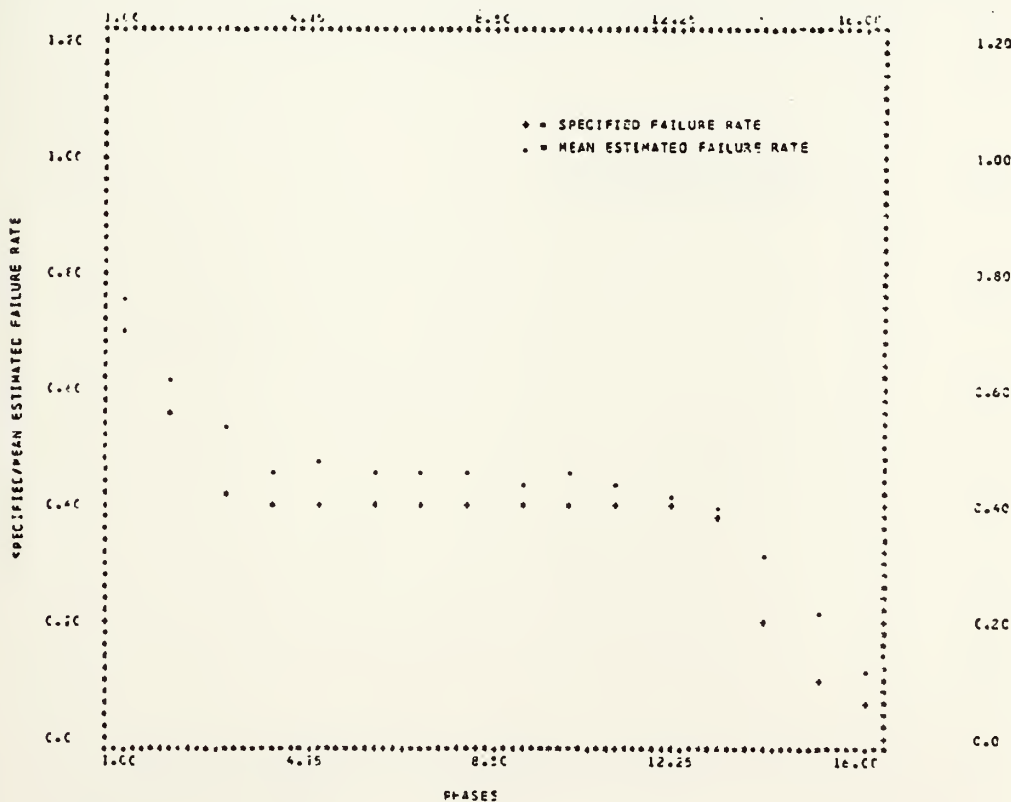
| PHASE   | 9       | 10      | 11      | 12      | 13      | 14      | 15      | 16      |
|---|---------|---------|---------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.4000  | 0.4000  | 0.4000  | 0.4000  | 0.3750  | 0.2000  | 0.1000  | 0.0500  |
| PLANNED TEST TIME                                   | 0.4063  | 0.4063  | 0.4063  | 0.4063  | 0.4234  | 0.8126  | 1.6252  | 3.2504  |
| POCEL ESTIMATE                                      | 0.4594  | 0.4719  | 0.4693  | 0.4749  | 0.4861  | 0.2763  | 0.2360  | 0.1286  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 23.85   | 17.97   | 17.32   | 18.74   | 25.64   | 66.12   | 135.96  | 157.29  |
| SAMPLE STD DEVIATION                                | 0.2732  | 0.2569  | 0.2628  | 0.2450  | 0.2440  | 0.2103  | 0.1032  | 0.0447  |
| CUMULATIVE TEST TIME                                | 30.943  | 34.723  | 38.459  | 42.187  | 46.178  | 53.627  | 66.565  | 98.201  |
| CUMULATIVE FAILURES                                 | 13.0700 | 14.4500 | 16.0100 | 17.5700 | 19.1600 | 20.8000 | 22.2600 | 23.5300 |





| PHASE   | 1      | 2      | 3      | 4       | 5       | 6       | 7       | 8       |
|---|--------|--------|--------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.3000 | 0.4250 | 0.4050  | 0.4000  | 0.4000  | 0.4000  | 0.4000  |
| PLANNED TEST TIME                                   | 0.2322 | 0.2955 | 0.3624 | 0.4013  | 0.4063  | 0.4063  | 0.4063  | 0.4063  |
| MODEL ESTIMATE                                      | 0.7576 | 0.6134 | 0.5322 | 0.4618  | 0.4709  | 0.4524  | 0.4506  | 0.4687  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 8.23   | 11.53  | 25.22  | 14.02   | 17.63   | 13.05   | 12.64   | 17.15   |
| SAMPLE STD DEVIATION                                | 0.4160 | 0.3452 | 0.3033 | 0.2545  | 0.2521  | 0.2209  | 0.1829  | 0.1866  |
| CUMULATIVE TEST TIME                                | 4.112  | 9.798  | 16.674 | 24.303  | 31.756  | 36.327  | 46.745  | 54.788  |
| CUMULATIVE FAILURES                                 | 2.9500 | 5.8000 | 8.8700 | 11.7100 | 14.7100 | 17.7100 | 20.8300 | 24.0700 |

| PHASE   | 9       | 10      | 11      | 12      | 13      | 14      | 15      | 16      |
|---|---------|---------|---------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.4000  | 0.4000  | 0.4000  | 0.4000  | 0.3750  | 0.2000  | 0.1000  | 0.0500  |
| PLANNED TEST TIME                                   | 0.4063  | 0.4063  | 0.4063  | 0.4063  | 0.4334  | 0.8126  | 1.6252  | 3.2504  |
| MODEL ESTIMATE                                      | 0.4276  | 0.4204  | 0.4331  | 0.4219  | 0.4086  | 0.3258  | 0.2192  | 0.1282  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 9.40    | 12.59   | 8.28    | 5.47    | 9.02    | 64.61   | 119.21  | 156.45  |
| SAMPLE STD DEVIATION                                | 0.1475  | 0.1569  | 0.1384  | 0.1201  | 0.1133  | 0.0667  | 0.0646  | 0.0387  |
| CUMULATIVE TEST TIME                                | 61.676  | 69.132  | 76.672  | 84.172  | 92.154  | 107.154 | 127.220 | 197.432 |
| CUMULATIVE FAILURES                                 | 27.0000 | 30.2200 | 33.2300 | 36.1700 | 39.0600 | 42.0000 | 44.8000 | 47.8000 |



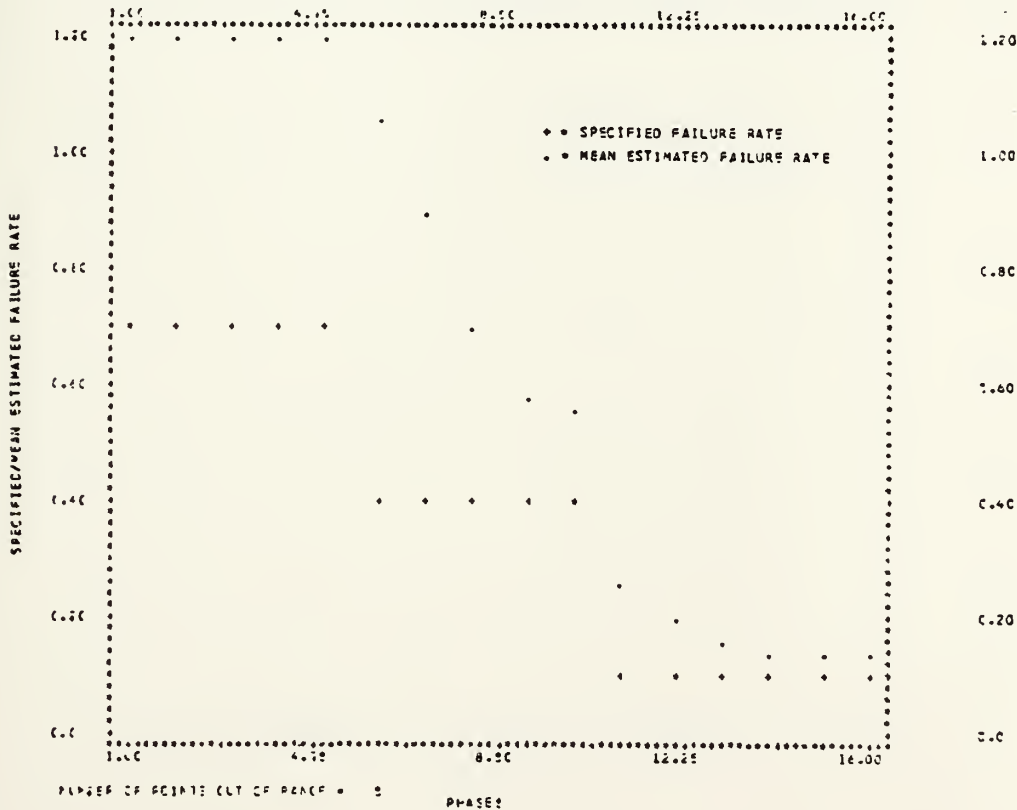




5 STEP:

| PHASE   | 1      | 2      | 3      | 4      | 5      | 6      | 7      | 8      |
|---|--------|--------|--------|--------|--------|--------|--------|--------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.7000 | 0.7000 | 0.7000 | 0.7000 | 0.4000 | 0.4000 | 0.4000 |
| PLANNED TEST TIME                                   | 0.2322 | 0.2322 | 0.2322 | 0.2322 | 0.2322 | 0.4063 | 0.4063 | 0.4063 |
| MCCEL ESTIMATE                                      | 1.2652 | 1.4365 | 1.3739 | 1.4043 | 1.3352 | 1.0660 | 0.9046 | 0.7035 |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 95.03  | 106.36 | 96.28  | 100.61 | 90.74  | 166.51 | 126.16 | 72.86  |
| SAMPLE STD DEVIATION                                | 0.6434 | 0.8648 | 0.7521 | 0.7801 | 0.6851 | 0.7149 | 0.6319 | 0.4647 |
| CUMULATIVE TEST TIME                                | 1.061  | 2.126  | 3.209  | 4.305  | 5.374  | 7.210  | 9.075  | 10.966 |
| CUMULATIVE FAILURES                                 | 0.7000 | 1.4100 | 2.1100 | 2.8400 | 3.5500 | 4.4600 | 5.1800 | 6.0100 |

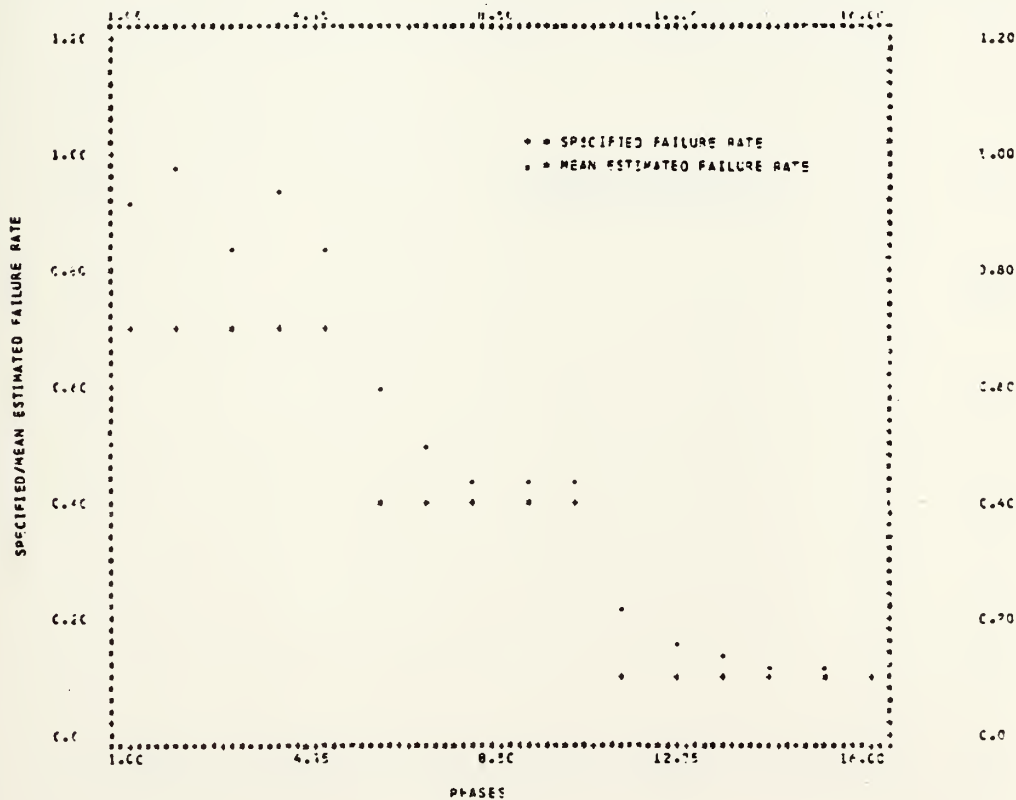
| PHASE   | 9      | 10     | 11     | 12     | 13     | 14      | 15      | 16      |
|---|--------|--------|--------|--------|--------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.4000 | 0.4000 | 0.1000 | 0.1000 | 0.1000 | 0.1000  | 0.1000  | 0.1000  |
| PLANNED TEST TIME                                   | 0.4063 | 0.4063 | 1.6252 | 1.6252 | 1.6252 | 1.6252  | 1.6252  | 1.6252  |
| MCCEL ESTIMATE                                      | 0.5870 | 0.5612 | 0.2547 | 0.1974 | 0.1613 | 0.1387  | 0.1358  | 0.1407  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 46.75  | 40.30  | 124.71 | 57.37  | 61.23  | 38.75   | 35.19   | 40.72   |
| SAMPLE STD DEVIATION                                | 0.3953 | 0.4226 | 0.1452 | 0.1285 | 0.0885 | 0.0777  | 0.0821  | 0.1032  |
| CUMULATIVE TEST TIME                                | 12.856 | 14.742 | 22.241 | 25.722 | 31.201 | 44.676  | 52.044  | 59.923  |
| CUMULATIVE FAILURES                                 | 6.6800 | 7.3800 | 7.9800 | 8.9000 | 9.7000 | 10.4000 | 11.3000 | 12.1500 |





| PHASE   | 1      | 2      | 3      | 4      | 5      | 6      | 7      | 8       |
|---|--------|--------|--------|--------|--------|--------|--------|---------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.7000 | 0.7000 | 0.7000 | 0.7000 | 0.4000 | 0.4000 | 0.4000  |
| PLANNED TEST TIME                                   | 0.2322 | 0.2322 | 0.2322 | 0.2322 | 0.2322 | 0.4063 | 0.4063 | 0.4063  |
| MODEL ESTIMATE                                      | 0.9162 | 0.9703 | 0.8404 | 0.9337 | 0.8485 | 0.5953 | 0.5020 | 0.4403  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 31.22  | 38.63  | 20.05  | 32.38  | 21.21  | 46.62  | 25.76  | 10.07   |
| SAMPLE STD DEVIATION                                | 0.5079 | 0.5932 | 0.4066 | 0.4841 | 0.4928 | 0.3927 | 0.3424 | 0.2100  |
| CUMULATIVE TEST TIME                                | 2.128  | 4.277  | 6.441  | 8.593  | 10.729 | 14.459 | 18.267 | 22.093  |
| CUMULATIVE FAILURES                                 | 1.3500 | 2.9500 | 4.3100 | 5.9200 | 7.1800 | 8.6600 | 9.9800 | 11.2900 |

| PHASE   | 9       | 10      | 11      | 12      | 13      | 14      | 15      | 16      |
|---|---------|---------|---------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.4000  | 0.4000  | 0.1000  | 0.1000  | 0.1000  | 0.1000  | 0.1000  | 0.1000  |
| PLANNED TEST TIME                                   | 0.4063  | 0.4063  | 1.6252  | 1.6252  | 1.6252  | 1.6252  | 1.6252  | 1.6252  |
| MODEL ESTIMATE                                      | 0.4497  | 0.4208  | 0.2285  | 0.1646  | 0.1401  | 0.1240  | 0.1125  | 0.1098  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 12.43   | 7.71    | 128.46  | 64.57   | 40.12   | 24.01   | 15.21   | 9.77    |
| SAMPLE STD DEVIATION                                | 0.2474  | 0.1931  | 0.1026  | 0.0577  | 0.0493  | 0.0446  | 0.0360  | 0.0331  |
| CUMULATIVE TEST TIME                                | 25.821  | 29.865  | 44.552  | 59.418  | 74.438  | 89.320  | 104.331 | 119.306 |
| CUMULATIVE FAILURES                                 | 12.7500 | 14.1500 | 15.7600 | 17.4500 | 19.0200 | 20.5800 | 22.1800 | 23.7400 |



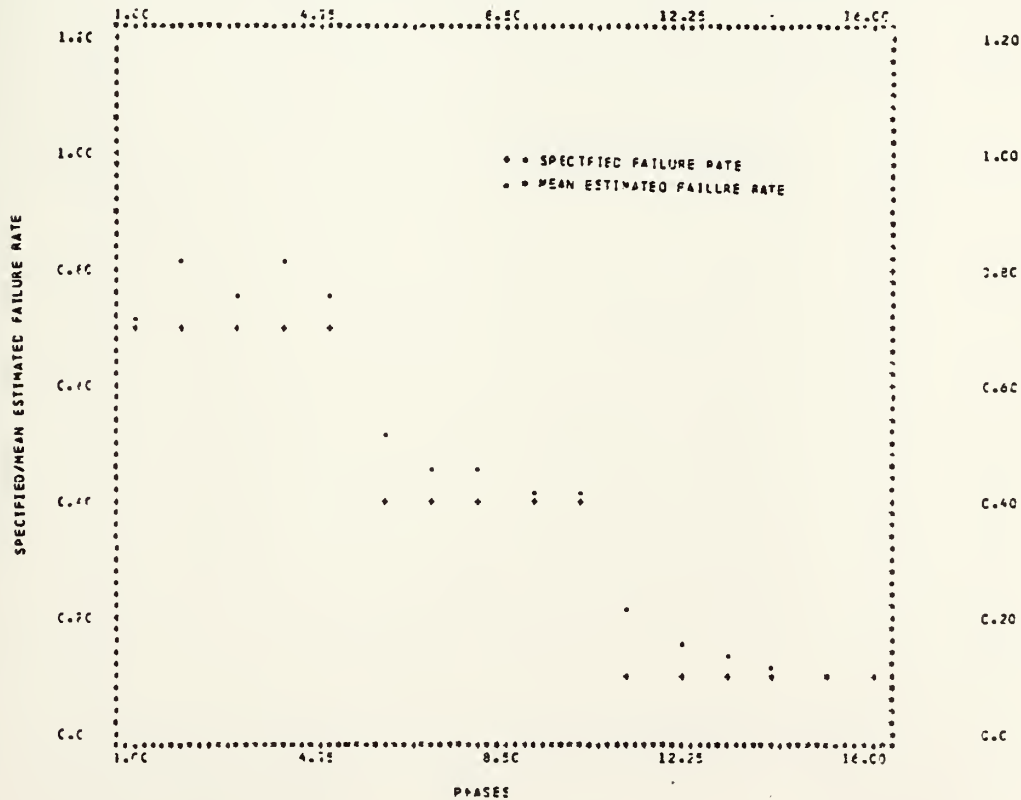


CASE 6

20 ITEMS

| PHASE   | 1      | 2      | 3      | 4       | 5       | 6       | 7       | 8       |
|---|--------|--------|--------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.7000 | 0.7000 | 0.7000  | 0.7000  | 0.4000  | 0.4000  | 0.4000  |
| PLANNED TEST TIME                                   | 0.2322 | 0.2322 | 0.2322 | 0.2322  | 0.2322  | 0.4063  | 0.4063  | 0.4063  |
| MCCEL ESTIMATE                                      | 0.7251 | 0.8171 | 0.7619 | 0.8146  | 0.7683  | 0.5247  | 0.4575  | 0.4586  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 3.58   | 16.72  | 8.84   | 16.37   | 9.76    | 31.16   | 14.48   | 14.64   |
| SAMPLE STD DEVIATION                                | 0.4087 | 0.4078 | 0.4044 | 0.4183  | 0.3747  | 0.2258  | 0.1844  | 0.1675  |
| CUMULATIVE TEST TIME                                | 4.294  | 8.961  | 12.842 | 17.130  | 21.415  | 28.965  | 36.410  | 43.631  |
| CUMULATIVE FAILURES                                 | 2.7000 | 6.0000 | 9.2000 | 12.3000 | 19.2100 | 18.0700 | 21.0200 | 24.3000 |

| PHASE   | 9       | 10      | 11      | 12      | 13      | 14      | 15      | 16      |
|---|---------|---------|---------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.4000  | 0.4000  | 0.1000  | 0.1000  | 0.1000  | 0.1000  | 0.1000  | 0.1000  |
| PLANNED TEST TIME                                   | 0.4063  | 0.4063  | 1.6252  | 1.6252  | 1.6252  | 1.6252  | 1.6252  | 1.6252  |
| MCCEL ESTIMATE                                      | 0.4145  | 0.4227  | 0.2133  | 0.1596  | 0.1348  | 0.1176  | 0.1075  | 0.1009  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 3.73    | 5.65    | 113.25  | 56.63   | 34.83   | 17.98   | 7.66    | 0.90    |
| SAMPLE STD DEVIATION                                | 0.1444  | 0.1427  | 0.0866  | 0.0491  | 0.0376  | 0.0222  | 0.0267  | 0.0215  |
| CUMULATIVE TEST TIME                                | 51.272  | 58.656  | 88.818  | 118.487 | 148.455 | 178.215 | 206.545 | 238.637 |
| CUMULATIVE FAILURES                                 | 27.0000 | 30.0000 | 33.1700 | 36.4600 | 39.4300 | 42.3500 | 45.2600 | 48.2200 |

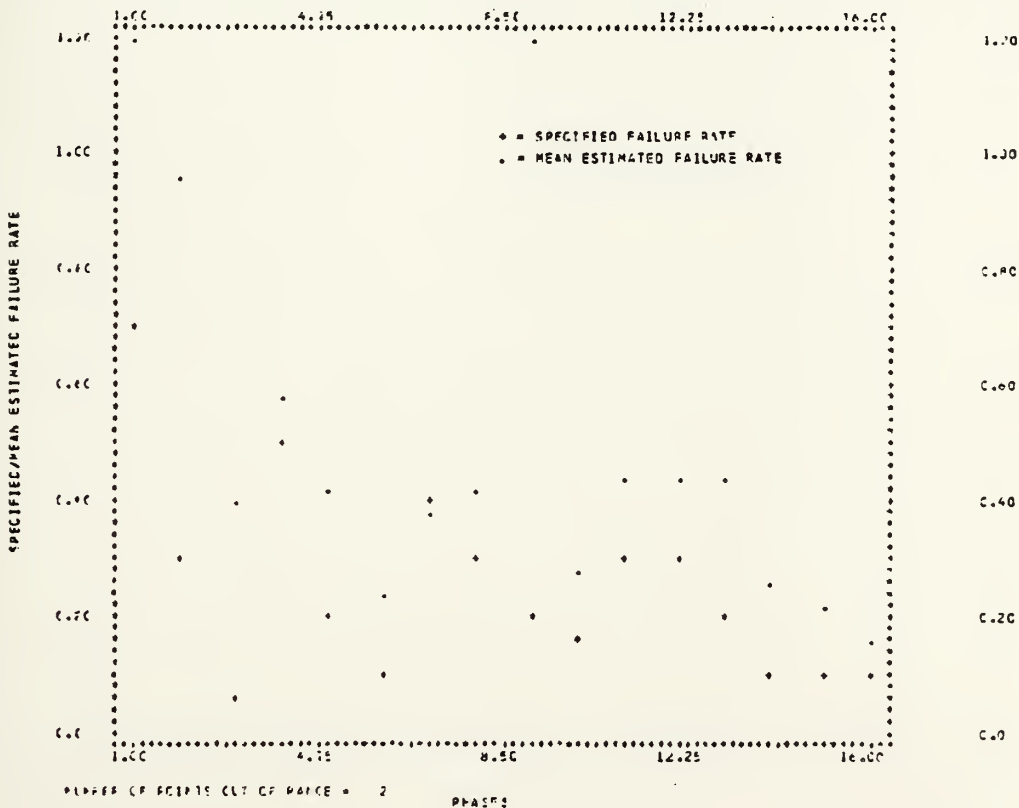




5 STEPS

| PHASE   | 1      | 2      | 3      | 4      | 5      | 6      | 7      | 8      |
|---|--------|--------|--------|--------|--------|--------|--------|--------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.3000 | 0.0500 | 0.5000 | 0.2000 | 0.1000 | 0.4000 | 0.2000 |
| PLANNED TEST TIME                                   | 0.2322 | 0.5417 | 3.2504 | 0.3250 | 0.6126 | 1.6252 | 0.4063 | 0.5417 |
| MCCEL ESTIMATE                                      | 1.5230 | 0.9658 | 0.4066 | 0.5736 | 0.4183 | 0.7461 | 0.3870 | 0.4272 |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 117.57 | 223.26 | 713.18 | 14.72  | 105.13 | 146.15 | 3.22   | 40.41  |
| SAMPLE STD DEVIATION                                | 1.0053 | 0.8302 | 0.8305 | 0.6133 | 0.4054 | 0.2845 | 0.4862 | 0.2511 |
| CUMULATIVE TEST TIME                                | 1.074  | 3.573  | 18.481 | 15.990 | 23.722 | 31.225 | 35.112 | 39.575 |
| CUMULATIVE FAILURES                                 | 0.7000 | 1.4000 | 2.1600 | 2.9300 | 3.6900 | 4.4200 | 5.0500 | 5.6700 |

| PHASE   | 9       | 10     | 11     | 12     | 13     | 14      | 15      | 16      |
|---|---------|--------|--------|--------|--------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.2000  | 0.1500 | 0.3000 | 0.3000 | 0.2000 | 0.1000  | 0.1000  | 0.1000  |
| PLANNED TEST TIME                                   | 0.8126  | 1.0625 | 0.5417 | 0.5417 | 0.8126 | 1.6252  | 1.6252  | 1.6252  |
| MCCEL ESTIMATE                                      | 2.3376  | 0.2756 | 0.4435 | 0.4432 | 0.4311 | 0.2664  | 0.2146  | 0.1606  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 1068.78 | 83.72  | 48.62  | 47.76  | 115.55 | 168.36  | 114.62  | 60.60   |
| SAMPLE STD DEVIATION                                | 15.7454 | 0.2210 | 0.6655 | 0.2964 | 0.3810 | 0.2275  | 0.2007  | 0.1181  |
| CUMULATIVE TEST TIME                                | 39.331  | 44.288 | 46.786 | 49.254 | 53.005 | 60.464  | 66.057  | 75.725  |
| CUMULATIVE FAILURES                                 | 6.3900  | 7.4200 | 8.3100 | 9.1000 | 9.8100 | 10.5100 | 11.3500 | 11.6500 |



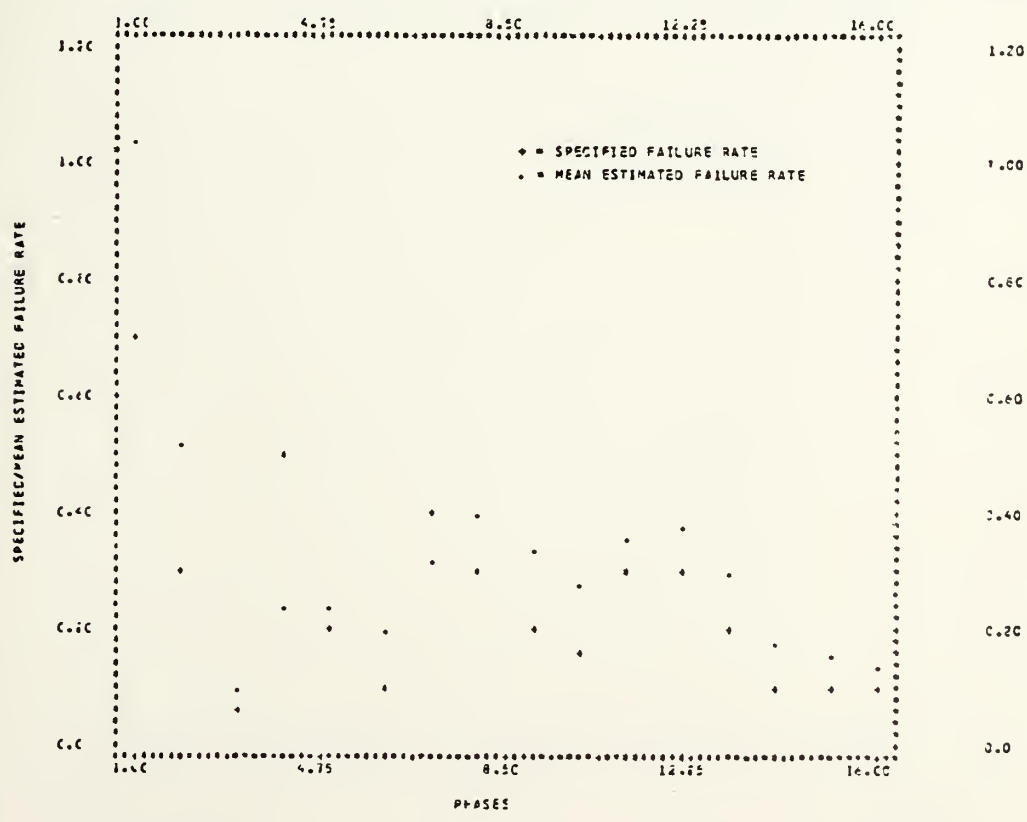




10 TESTS

| PHASE   | 1      | 2      | 3      | 4      | 5      | 6      | 7       | 8       |
|---|--------|--------|--------|--------|--------|--------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.3000 | 0.0500 | 0.5000 | 0.2000 | 0.1000 | 0.4000  | 0.2000  |
| PLANNED TEST TIME                                   | 0.2502 | 0.2417 | 3.2504 | 0.3250 | 0.8126 | 1.6252 | 0.4063  | 0.2417  |
| MODEL ESTIMATE                                      | 1.0352 | 0.5182 | 0.0557 | 0.2490 | 0.2351 | 0.1500 | 0.3264  | 0.4017  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 48.46  | 72.74  | 55.36  | 50.20  | 15.55  | 50.02  | 17.65   | 33.50   |
| SAMPLE STD DEVIATION                                | 0.5288 | 0.2643 | 0.1558 | 0.3890 | 0.2020 | 0.1758 | 0.2563  | 0.2572  |
| CUMULATIVE TEST TIME                                | 2.104  | 7.083  | 37.101 | 40.105 | 47.606 | 62.576 | 66.304  | 73.262  |
| CUMULATIVE FAILURES                                 | 1.7700 | 3.2400 | 4.8500 | 6.3000 | 7.5200 | 9.2500 | 10.5500 | 12.5500 |

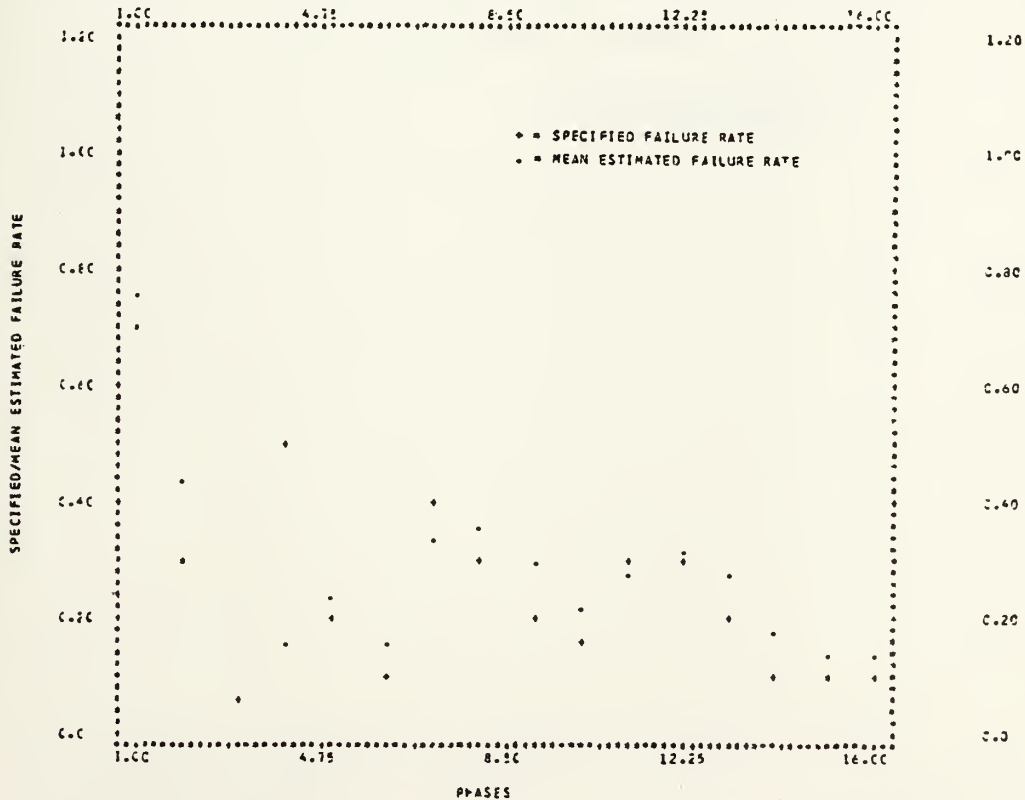
| PHASE   | 9       | 10      | 11      | 12      | 13      | 14      | 15      | 16      |
|---|---------|---------|---------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.2000  | 0.1500  | 0.3000  | 0.3000  | 0.2000  | 0.1000  | 0.1000  | 0.1000  |
| PLANNED TEST TIME                                   | 0.8126  | 1.0625  | 0.5417  | 0.5417  | 0.8126  | 1.6252  | 1.6252  | 1.6252  |
| MODEL ESTIMATE                                      | 0.2430  | 0.2760  | 0.3541  | 0.3716  | 0.2520  | 0.1862  | 0.1548  | 0.1415  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 71.52   | 84.02   | 18.03   | 23.95   | 46.01   | 66.28   | 54.77   | 41.52   |
| SAMPLE STD DEVIATION                                | 0.3057  | 0.2157  | 0.3028  | 0.2882  | 0.2416  | 0.0560  | 0.0762  | 0.0631  |
| CUMULATIVE TEST TIME                                | 78.788  | 88.725  | 93.707  | 98.702  | 106.248 | 121.305 | 126.257 | 151.152 |
| CUMULATIVE FAILURES                                 | 12.8300 | 15.4000 | 17.1800 | 18.6800 | 20.1100 | 21.4200 | 23.2500 | 24.8700 |





| PHASE   | 1      | 2      | 3      | 4       | 5       | 6       | 7       | 8       |
|---|--------|--------|--------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.7000 | 0.3000 | 0.0500 | 0.9000  | 0.2000  | 0.1000  | 0.4000  | 0.3000  |
| PLANNED TEST TIME                                   | 0.2222 | 0.9417 | 3.2904 | 0.3250  | 0.8126  | 1.6252  | 0.4063  | 0.9417  |
| ACCEL ESTIMATE                                      | 0.7622 | 0.4386 | 0.0605 | 0.1631  | 0.2373  | 0.1818  | 0.2774  | 0.2643  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 8.89   | 46.19  | 20.98  | 67.39   | 18.66   | 61.76   | 16.89   | 21.44   |
| SAMPLE STD DEVIATION                                | 0.4209 | 0.3192 | 0.0396 | 0.2237  | 0.1373  | 0.1054  | 0.3696  | 0.1821  |
| CUMULATIVE TEST TIME                                | 4.272  | 14.288 | 74.066 | 80.098  | 99.034  | 124.511 | 132.546 | 142.278 |
| CUMULATIVE FAILURES                                 | 2.9500 | 5.8100 | 9.0000 | 11.7600 | 14.8800 | 18.0500 | 21.3200 | 24.4900 |

| PHASE   | 9       | 10      | 11      | 12      | 13      | 14      | 15      | 16      |
|---|---------|---------|---------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.2000  | 0.1000  | 0.3000  | 0.3000  | 0.2000  | 0.1000  | 0.1000  | 0.1000  |
| PLANNED TEST TIME                                   | 0.8126  | 1.0659  | 0.5417  | 0.5417  | 0.8126  | 1.6252  | 1.6252  | 1.6252  |
| ACCEL ESTIMATE                                      | 0.2951  | 0.2206  | 0.2749  | 0.3298  | 0.2730  | 0.1792  | 0.1454  | 0.1323  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 47.50   | 47.05   | 8.37    | 9.92    | 36.52   | 75.21   | 45.38   | 32.26   |
| SAMPLE STD DEVIATION                                | 0.1676  | 0.1087  | 0.1547  | 0.2071  | 0.1417  | 0.0763  | 0.0588  | 0.0471  |
| CUMULATIVE TEST TIME                                | 157.243 | 177.242 | 187.247 | 197.196 | 212.194 | 242.173 | 272.258 | 302.306 |
| CUMULATIVE FAILURES                                 | 27.4000 | 39.4000 | 33.4100 | 36.6600 | 39.6100 | 42.6600 | 45.4600 | 48.4300 |



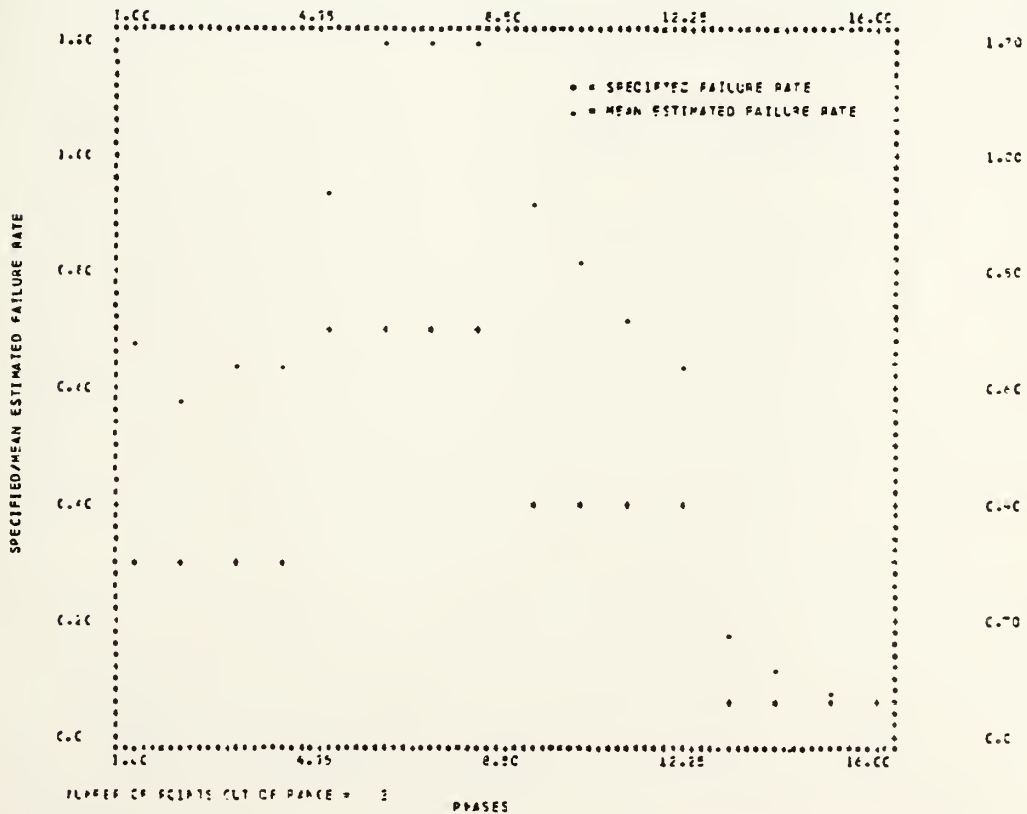


CASE 10

5 STEPS

| PHASE   | 1      | 2      | 3      | 4      | 5      | 6      | 7      | 8      |
|---|--------|--------|--------|--------|--------|--------|--------|--------|
| ACTUAL FAILURE RATE                                 | 0.3000 | 0.3000 | 0.3000 | 0.3000 | 0.7000 | 0.7000 | 0.7000 | 0.7000 |
| PLANNED TEST TIME                                   | 0.5417 | 0.5417 | 0.5417 | 0.5417 | 0.2322 | 0.2322 | 0.2322 | 0.2322 |
| MCCEL ESTIMATE                                      | 0.6856 | 0.5759 | 0.6478 | 0.6385 | 0.9375 | 1.2371 | 1.2028 | 1.2373 |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 128.83 | 91.56  | 119.95 | 112.83 | 33.93  | 76.73  | 71.82  | 76.76  |
| SAMPLE STC COEFFICIENT                              | 0.3624 | 0.3068 | 0.3514 | 0.3528 | 0.6932 | 0.8600 | 0.8665 | 0.8907 |
| CUMULATIVE TEST TIME                                | 2.109  | 5.042  | 7.907  | 10.020 | 11.119 | 12.158 | 13.223 | 14.288 |
| CUMULATIVE FAILURES                                 | 0.7100 | 1.3300 | 2.1800 | 2.8300 | 3.4000 | 4.3900 | 5.1000 | 6.0900 |

| PHASE   | 9      | 10     | 11     | 12     | 13     | 14      | 15      | 16      |
|---|--------|--------|--------|--------|--------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.4000 | 0.4000 | 0.4000 | 0.4000 | 0.0500 | 0.0500  | 0.0500  | 0.0500  |
| PLANNED TEST TIME                                   | 0.4063 | 0.4063 | 0.4063 | 0.4063 | 2.2504 | 3.2504  | 3.2504  | 3.2504  |
| MCCEL ESTIMATE                                      | 0.9224 | 0.8152 | 0.7253 | 0.6333 | 0.1795 | 0.1123  | 0.0762  | 0.0673  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 130.59 | 103.80 | 81.33  | 58.33  | 259.06 | 124.64  | 56.41   | 34.60   |
| SAMPLE STC COEFFICIENT                              | 0.8110 | 0.5379 | 0.5256 | 0.3740 | 0.0898 | 0.0691  | 0.0324  | 0.0299  |
| CUMULATIVE TEST TIME                                | 16.166 | 18.057 | 19.541 | 21.804 | 26.765 | 31.970  | 67.164  | 82.933  |
| CUMULATIVE FAILURES                                 | 6.7000 | 7.8300 | 8.2700 | 8.9700 | 9.8100 | 10.6000 | 11.2000 | 11.9700 |

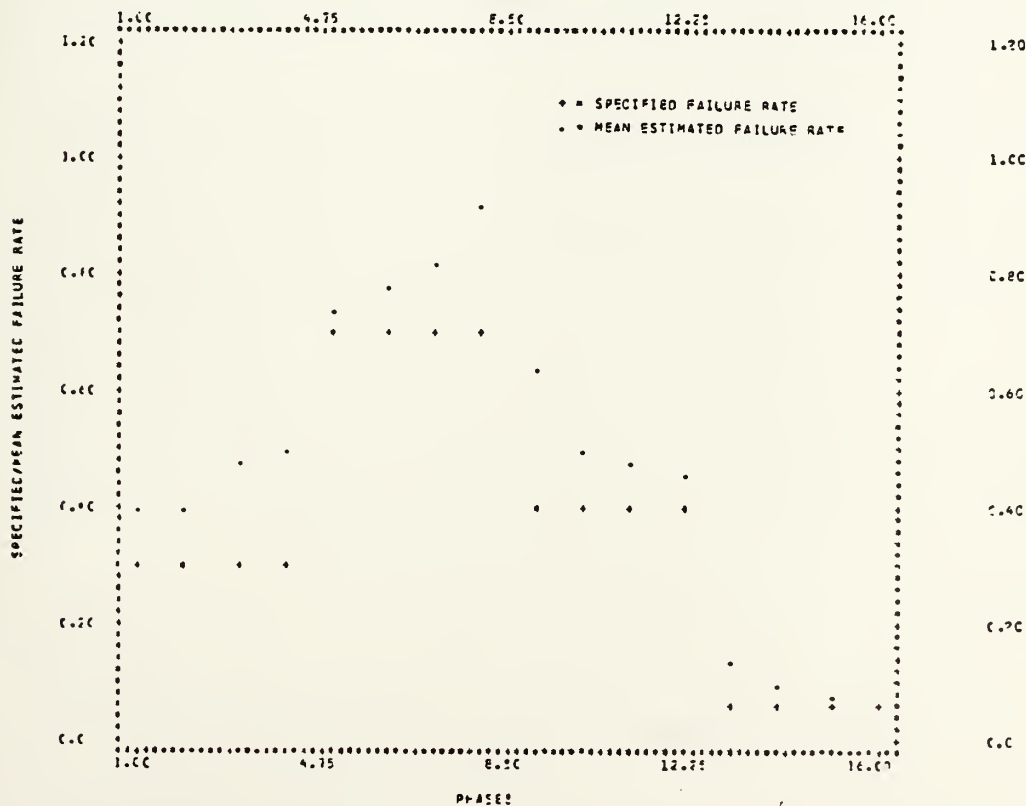




10 ITEMS

| PHASE   | 1      | 2      | 3      | 4      | 5      | 6      | 7       | 8       |
|---|--------|--------|--------|--------|--------|--------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.3000 | 0.3000 | 0.3000 | 0.3000 | 0.7000 | 0.7000 | 0.7000  | 0.7000  |
| PLANNED TEST TIME                                   | 0.5417 | 0.5417 | 0.5417 | 0.5417 | 0.2122 | 0.2122 | 0.2122  | 0.2122  |
| MODEL ESTIMATE                                      | 0.4051 | 0.3941 | 0.4895 | 0.4951 | 0.7465 | 0.7703 | 0.8223  | 0.9147  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 36.36  | 31.37  | 63.17  | 65.02  | 6.70   | 10.04  | 17.47   | 30.67   |
| SAMPLE STD DEVIATION                                | 0.2190 | 0.2243 | 0.3764 | 0.2533 | 0.3528 | 0.4665 | 0.4525  | 0.2060  |
| CUMULATIVE TEST TIME                                | 4.427  | 5.932  | 14.858 | 19.747 | 21.909 | 24.061 | 26.213  | 28.341  |
| CUMULATIVE FAILURES                                 | 1.2500 | 2.5700 | 4.7300 | 6.5600 | 7.9700 | 9.1400 | 10.5900 | 12.4700 |

| PHASE   | 9       | 10      | 11      | 12      | 13      | 14      | 15      | 16      |
|---|---------|---------|---------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.4000  | 0.4000  | 0.4000  | 0.4000  | 0.0500  | 0.0500  | 0.0500  | 0.0500  |
| PLANNED TEST TIME                                   | 0.4063  | 0.4063  | 0.4063  | 0.4063  | 2.2504  | 3.2104  | 3.2504  | 3.2504  |
| MODEL ESTIMATE                                      | 0.6387  | 0.4585  | 0.4821  | 0.4680  | 0.1470  | 0.0542  | 0.0755  | 0.0616  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 59.67   | 24.63   | 20.53   | 16.95   | 154.08  | 89.02   | 21.62   | 23.12   |
| SAMPLE STD DEVIATION                                | 0.3417  | 0.2025  | 0.2164  | 0.1934  | 0.0787  | 0.0633  | 0.0565  | 0.0276  |
| CUMULATIVE TEST TIME                                | 22.129  | 35.920  | 39.705  | 43.459  | 75.610  | 103.726 | 123.725 | 163.686 |
| CUMULATIVE FAILURES                                 | 13.8200 | 15.0600 | 16.5900 | 16.0700 | 15.4800 | 20.8400 | 22.3300 | 22.8300 |

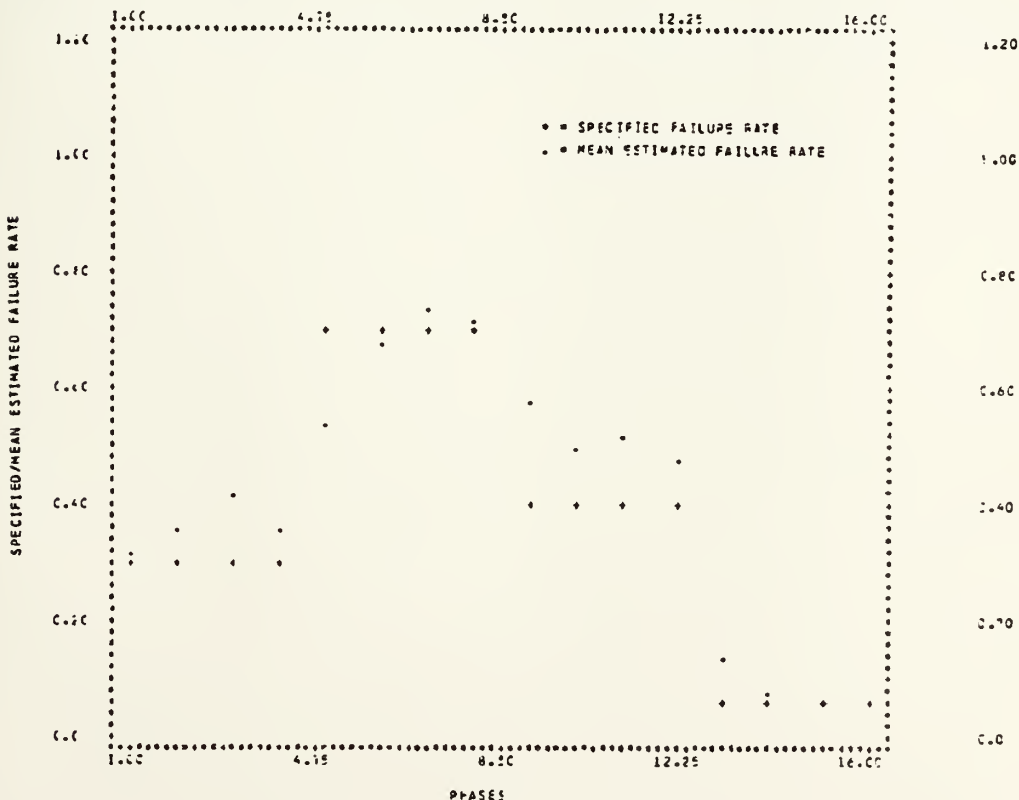






| PHASE   | 1      | 2      | 3      | 4       | 5       | 6       | 7       | 8       |
|---|--------|--------|--------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.3000 | 0.3000 | 0.3000 | 0.3000  | 0.7000  | 0.7000  | 0.7000  | 0.7000  |
| PLANNED TEST TIME                                   | 0.5417 | 0.5417 | 0.5417 | 0.5417  | 0.2322  | 0.2322  | 0.2322  | 0.2322  |
| MODEL ESTIMATE                                      | 0.3215 | 0.3610 | 0.4102 | 0.3591  | 0.5376  | 0.6789  | 0.7351  | 0.7270  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 7.16   | 20.34  | 36.75  | 19.77   | 23.21   | 3.02    | 4.30    | 3.66    |
| SAMPLE STC DEVIATION                                | 0.1635 | 0.2147 | 0.3270 | 0.1976  | 0.2854  | 0.3245  | 0.4018  | 0.3486  |
| CUMULATIVE TEST TIME                                | 5.556  | 15.586 | 25.850 | 39.508  | 44.206  | 46.475  | 52.744  | 57.025  |
| CUMULATIVE FAILURES                                 | 3.0300 | 5.9000 | 9.1600 | 12.0600 | 14.8100 | 18.1200 | 21.0300 | 23.9500 |

| PHASE   | 9       | 10      | 11      | 12      | 13      | 14      | 15      | 16      |
|---|---------|---------|---------|---------|---------|---------|---------|---------|
| ACTUAL FAILURE RATE                                 | 0.4000  | 0.4000  | 0.4000  | 0.4000  | 0.0500  | 0.0500  | 0.0500  | 0.0500  |
| PLANNED TEST TIME                                   | 0.4063  | 0.4063  | 0.4063  | 0.4063  | 3.2504  | 3.7504  | 3.2504  | 3.2504  |
| MODEL ESTIMATE                                      | 0.5732  | 0.5011  | 0.5129  | 0.4748  | 0.1314  | 0.0814  | 0.0663  | 0.0587  |
| ESTIMATE ERROR AS PERCENTAGE OF ACTUAL FAILURE RATE | 43.46   | 25.28   | 28.22   | 18.70   | 174.86  | 74.82   | 36.64   | 17.42   |
| SAMPLE STC DEVIATION                                | 0.2710  | 0.2315  | 0.2284  | 0.1613  | 0.0597  | 0.0360  | 0.0251  | 0.0188  |
| CUMULATIVE TEST TIME                                | 64.565  | 72.051  | 75.547  | 87.097  | 147.563 | 208.226 | 267.726 | 327.822 |
| CUMULATIVE FAILURES                                 | 26.5100 | 29.8600 | 33.1100 | 36.0300 | 36.5000 | 41.5400 | 44.6200 | 47.9500 |





## LIST OF REFERENCES

1. Military Handbook for Reliability Growth Management, Proposed MIL-HDBK-XXX, 7 July 1978.
2. Crow, L. H., 1975, "On Tracking Reliability Growth", Proceedings 1975 Annual Reliability and Maintainability Symposium.



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